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No. 3.

PRACTICAL MENSURATION

FOR

SCHOOLS AND COLLEGES.

BY

W. V. WRIGHT, B.A.

PUBLISHED BY

THE SUPPLEMENT CO.,

50 BROMFIELD ST., BOSTON, MASS.

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AUTHOR'S NOTE.

THIS book aims at furnishing work in *practical measurements* suitable for beginners — boys and girls having a fair knowledge of the elementary rules of arithmetic. The necessary technical information will be found in the introductory pages. The teacher should supplement these pages by the free use of blackboard and crayon. Except in the test papers at the end, the exercises do not presuppose a knowledge of geometry or of square root. The book is not, in the ordinary sense, mathematical. The matter of a large number of the exercises was built upon information secured by actual conversations with intelligent mechanics. The author hopes that the free use of this book in the school-room will aid in bringing the education of the mind more into harmony with the needs of every-day life.

PICKERING, October 19, 1887.

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PRACTICAL MENSURATION.

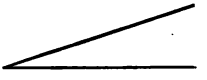
NOTES AND DEFINITIONS.

The subject of **mensuration**, as here treated, includes only such practical applications of the measures of surfaces, measures of volume, and measures of capacity, as are of common use.

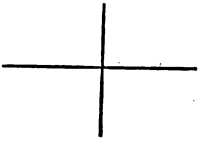
A **straight line** is a line which does not change in its direction.

Parallel lines are lines which always remain the same distance from each other, however far they may be produced.

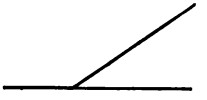
The opening between two straight lines drawn from the same point is called an **angle.**



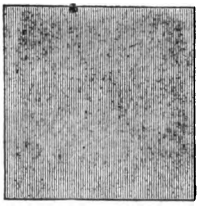
When two straight lines cross each other so as to form four equal angles, the angles are called **right angles.**



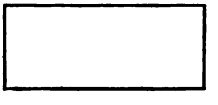
An angle greater than a right angle is called an **obtuse angle**, and an angle less than a right angle is called an **acute angle.**



A **surface** has length and breadth without thickness. A *plane* surface is a *level* surface. The amount of space over which a surface extends is called its **area.** The *area* of the accompanying figure is *one square inch.*



A surface bounded by four straight lines, and having four right angles, is called a **rectangle.**



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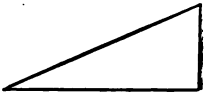
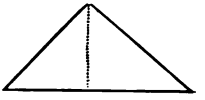
A *rectangle* is called a **square** when its four sides are equal.

The line joining two opposite corners of a square or rectangle is called the **diagonal.**

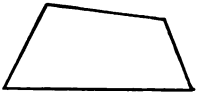
A plane figure bounded by three straight lines is a **triangle.** The **base** of a triangle is the side on which it is supposed to rest.



The **altitude** of a triangle is the perpendicular distance from the angle opposite the base to the base, or to the base produced.

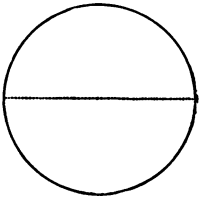


A four-sided plane figure having no two sides parallel is called a **trapezium.**

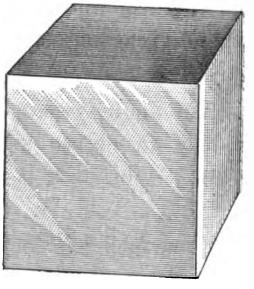


The **perimeter** of a plane figure is the sum of its sides.

A **circle** is a plane figure bounded by a curved line, every point of which is equally distant from a point within, called the **centre.** The boundary line is called the **circumference.** A straight line drawn through the centre and terminating at the circumference on both sides is called a **diameter.** A straight line drawn from the centre to the circumference is called a **radius.**



A **solid** has length, breadth, and thickness, or height. A **cube** is a solid figure contained by six equal squares. A **rectangular solid** is a solid figure contained by six angular surfaces.



The **volume** of a rectangular solid is the portion of space which it occupies.

A solid bounded by a curved surface, every point of which is equally distant from a point within, called the centre, is called a **globe,** or **sphere.**

A **cylinder** is a solid figure described by the revolution of a rectangle about one of its sides which remains fixed. An uncut lead-pencil is an example.

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MEASUREMENT TABLES.

Linear measure is used in measuring lengths and distances. The table is as follows:

12 inches	=	**1 foot**		*ft.*
3 feet	=	**1 yard**		*yd.*
5½ yards (16½ feet)	=	**1 rod**		*rd.*
320 rods	=	**1 mile**		*mi.*

Remember that 1 mile equals 1,760 yards.

Surveyor's lineal measure is used by surveyors in measuring land and distances. The table is as follows:

7.92 inches	=	**1 link**		*l.*
25 links	=	**1** rod		*rd.*
100 links (4 rods)	=	**1 chain**		*ch.*
80 chains	=	**1** mile		*mi.*

Remember that a chain equals 66 feet or 4 rods.

Surface measure is used in measuring surfaces. The table is as follows:

144 square inches	=	**1 square foot**		*sq. ft.*
9 square feet	=	**1 square yard**		*sq. yd.*
30¼ square yards	=	**1 square rod**		*sq. rd.*
160 square rods	=	**1 acre**		*A.*
640 acres	=	**1 square mile**		*sq. mi.*

A square measuring 208.71+ feet on each side contains 1 acre.

Surveyor's square measure is used by surveyors in computing the area of land. The table is as follows:

625 square links	=	**1 square rod**		*sq. rd.*
16 square rods	=	**1 square chain**		*sq. ch.*
10 square chains	=	**1 acre**		*A.*

An acre equals 4840 square yards.

Cubic measure is used to measure the contents or volume of solids. The table is as follows:

1728 cubic inches	=	**1 cubic foot**		*cu. ft.*
27 cubic feet	=	**1 cubic yard**		*cu. yd.*
128 cubic feet	=	**1 cord**		*cd.*

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MEASUREMENT OF RECTANGULAR PLANES.

The **area** of any rectangle is expressed by the product of the length and the breadth. Before multiplying it is necessary that both dimensions be expressed in units of the same denomination.

To **prove** the truth of this rule, draw a rectangle 7 inches long by 5 inches wide. Measure off the sides in inch spaces, and rule lines each way, one inch apart, dividing the rectangle into squares each containing 1 inch. Count the squares, and you will find that there are just 35, or a number equal to the product of 7 and 5.

In the same manner, if a **rectangle** be 4 feet long and 3 feet broad, its area is 12 *square feet;* that is, the rectangle might be divided into 12 equal figures, each being a foot long and a foot broad.

The **beginner** should observe very carefully the way in which areas are measured; it is a case of the general principle which applies to all measurable things. For example, when we measure lengths we fix on some length for a standard, as an inch or a foot, and we compare other lengths with the standard; thus when we say that a certain line is 17 inches long we mean that the line is 17 times as long as our standard, which is one inch. In like manner, when we measure areas we fix on some area for a standard, and we compare other areas with the standard.

MEASUREMENT OF RECTANGULAR SOLIDS.

The **volume** of a rectangular solid is expressed by the product of the length, breadth, and height, when the three dimensions are expressed in units of the same denomination.

To **measure** a solid block, or to find how much a box, a bin, or a cellar will contain, we have to ascertain, by actual measurement, its length, breadth, and depth, and with these three dimensions find the volume by simple multiplication. Thus, if we desire to find the number of cubic yards of earth removed in digging a cellar 40 feet long, 18 feet wide, and 10 feet deep, we multiply 40, 18, and 10 together, and get 7,200 feet, or 266⅔ cubic yards.

MEASUREMENT OF WOOD.

Wood cut in lengths of 4 feet is called **cord wood.** A pile of cord wood 4 feet high and 8 feet long, or equal bulk of other material, is called a **cord.**

Thus a cord of wood is 8 feet by 4 feet by 4 feet, and contains 128 cubic feet. To find the number of cords in a pile of wood or bark piled in the form of a rectangular solid, find its solid contents or volume in cubic feet, and divide the result by 128.

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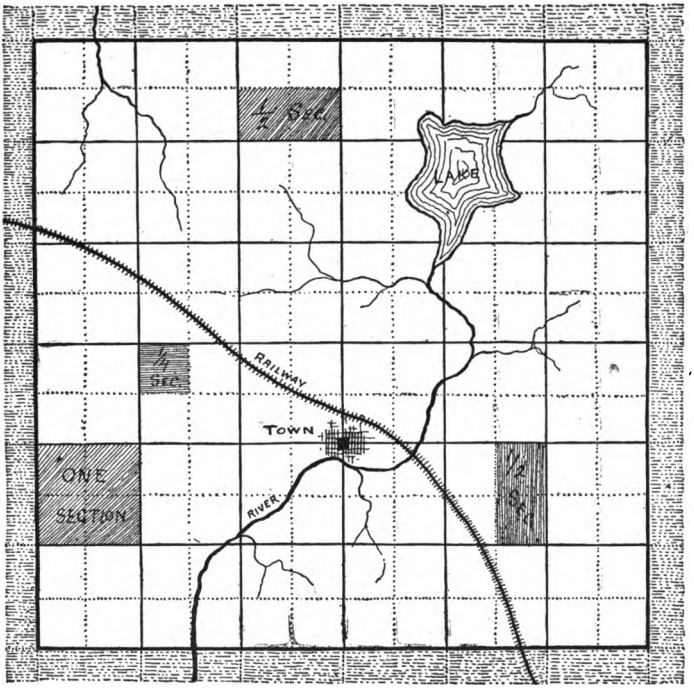
MEASUREMENT OF LAND.

United States and Canadian **public lands** are divided by north and south lines run according to the true meridian, and by others crossing them at right angles, into **townships** 6 miles square.

Townships are subdivided into **sections** 1 mile square, and containing 640 acres each. *Sections* are subdivided into *half-sections*, *quarter-sections*, and *half-quarter-sections*.



A TOWNSHIP.

The **survey** of each land-district begins by the establishing of *a true meridian* from some prominent point. This is called the **principal meridian.** From some point in the *principal meridian* is run a line due east and west, called the **base line.**

All the townships situated north or south of each other form a **range.** The ranges are named by their number east or west of the *principal meridian.* The townships in each range are named by numbers north or south of the base line.

There are **thirty-six sections** in each township. They are numbered from 1 to 36, beginning at the northeast corner and going west to 6, then east from 7 to 12, and so on alternately to section 36, which will be in the southeast corner of the township.

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To provide for the **error** that would result from the convergence of the meridians and to prevent it from becoming so great as to destroy the value of the system, standard parallels, or **correction lines**, are established at intervals north and south of the *base line*. From these *correction lines* the townships start again with their proper width. On these there are found *double corners*, both for townships and sections, one set being the closing corners of the surveys ending there, and the other set being the standard corners for the surveys starting there.

MEASUREMENT OF TRIANGLES.

Triangles are of various shapes. Sometimes they are named from their *sides;* thus, —

An **equilateral** triangle is that which has three equal sides.

An **isosceles** triangle is that which has only two sides equal.

A **scalene** triangle is that which has three unequal sides.

Sometimes **triangles** are named from their *angles ;* thus, —

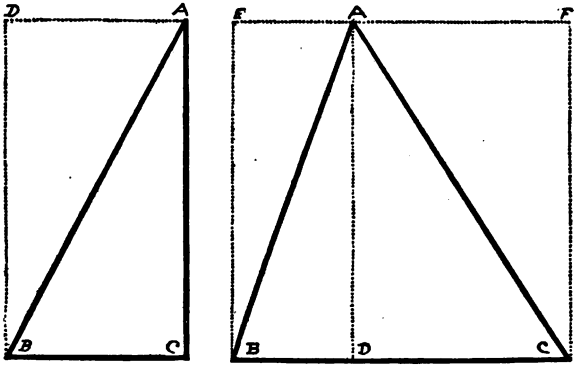
A **right-angled** triangle is that which has a right angle.

An **obtuse-angled** triangle is that which has an obtuse angle.

An **acute-angled** triangle is that which has an acute angle.

To find the area of a triangle you must know the base and the altitude.

In the first diagram BC is the **base** and DB the **altitude**; in the second BC is the *base* and AD the *altitude*. Now you have learned how to find the area of a rectangle, and each triangle is just half of a rectangle whose length and breadth are the same as the altitude and the base of the triangle. Then to



find the **area** of the *triangle*, find the area of the rectangle containing it and take half the result; that is, **take half of the product of the altitude and the base.**

If in the second diagram BC were 10 inches and AD 12 inches, the area of the triangle ABC would be $(10 \times 12) \div 2$, or 60 square inches.

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MEASUREMENT OF LUMBER.

Lumber, as the term is used here, includes all kinds of sawed boards, planks, scantlings, etc.

A **foot of lumber** is 1 foot long, 1 foot wide, and 1 inch thick, and is used as the unit of lumber measurement.

The term **scantling** is given to lumber 3 or 4 inches wide, and from 2 to 4 inches thick. **Joist** is usually narrow and deep. Lumber heavier than joist or scantling is called **timber.** Thick boards are called **planks.** The usual outside covering of wood houses is **siding.**

All lumber less than 1 inch in thickness is considered inch lumber in measuring.

In **measuring** the width of a board a fraction greater than a half-inch is called a half, and if less than a half it is rejected. A board $5\frac{7}{8}$ inches wide would be considered 6 inches wide.

The **price of lumber** is usually quoted at a certain rate per thousand feet.

A board 14 feet long, 12 inches wide, and 1 inch in thickness would contain $(14 \times 12 \times 1) \div 12$, or 14 feet. A board 10 feet long, 16 inches wide, and 3 inches thick would contain $(10 \times 16 \times 3) \div 12$, or 40 feet. Note that in measuring 12-foot lumber, 1 inch or less in thickness, the width of the board in inches is the number of feet it contains.

MEASUREMENT OF STONE-WORK.

A **cord of stone** is the same size as a cord of wood. In estimating stone-work no smaller part than quarter-cords is allowed.

A cord of stone will make about 100 cubic feet of **wall.**

In **estimating the amount of stone** or the cost of the mason-work, it is customary to measure around the **outside** of the wall, and make no allowance for openings except they are large.

Three bushels of lime and a cubic yard of sand **will lay a cord of stone.**

A **perch** of stone-work is 1 rod long, $1\frac{1}{2}$ feet thick, and 1 foot high: it contains $24\frac{3}{4}$ cubic feet. A fractional part of a perch is reckoned as a perch.

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MEASUREMENT OF BRICK-WORK.

Bricks vary so much in size and style, that a table of exact dimensions is impracticable. Ordinary bricks are 8½ inches long, 4 inches wide, and 2½ inches high.

It is sufficiently accurate to reckon 20 bricks to the cubic foot **laid dry**.

In **half-brick walls**, such as are built in veneering wooden houses, each brick, with the mortar required to lay it, has an external surface of 3 inches by 9 inches, or a brick is required for each 27 inches of surface.

In estimating material, corners are measured once, and allowance is made for doors and windows. **In estimating labor**, the corners are measured twice; that is, the outside measurement is taken, and usually one-half is deducted for openings.

MEASUREMENT OF SHINGLING.

Ordinary **shingles** have an average width of 4 inches, and are generally laid 4 inches to the weather.

A **bunch of shingles** contains a quarter of a thousand. It is 20 inches wide, and has 25 courses on each side.

Allowing for waste, 1,000, or **a square of shingles**, will lay 100 square feet, 4 inches to the weather.

MEASUREMENT OF LATHING.

A **bunch of laths** contains 50 laths. Laths are 4 feet long, 1½ inches wide, and are laid three-eighths of an inch apart.

Allowing for waste, contractors reckon that a bunch of **laths** will cover 3 square yards.

Lathing is estimated by the square yard. Only one-half the surface of openings is deducted.

MEASUREMENT OF PLASTERING.

Plastering is estimated by the square yard. Only half the surface of openings is charged.

MEASUREMENT OF PAINTING.

Painting and **kalsomining** are estimated by the square yard.

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MEASUREMENT OF WALL-PAPER.

Wall-paper is sold only by the roll, any part of a roll being counted as a whole one.

American **paper** is 18 inches wide, and has 24 feet in a single roll, and 48 feet in a double roll.

Paper-hangers measure the distance around the room in feet and deduct 3 feet for each door or window. The difference divided by $1\frac{1}{2}$ gives the number of strips.

The **exact cost** of papering a room can be ascertained only by taking account of the number of rolls actually used in doing the work.

MISCELLANEOUS RULES.

The rules quoted below are inserted here for reference.

To find the circumference of a circle: Multiply the diameter by 3.14159.

To find the diameter of a circle: Divide the circumference by 3.14159.

When the three sides of a triangle are given, to find the area: From half the sum of the three sides subtract each side separately. Multiply the half-sum and the three remainders together, and extract the square root of the product.

To find the area of a circle: Multiply the circumference by one-half of the radius.

To find the surface of a sphere: Multiply the circumference by the diameter.

To find the contents of a sphere: Multiply the surface of the sphere by one-third of the radius.

To find the hypothenuse of a right-angled triangle: Add the square of the base to that of the perpendicular, and take the square root of the sum.

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EXAMINATION QUESTIONS.

1. Distinguish between 9 square feet and 9 feet square.

2. Draw neat figures representing

a square,
a circle,
an isosceles triangle,
a trapezium,
a cube.

3. Show by a diagram that the angles of a triangle are equal to two right angles.

4. Distinguish between a linear and a superficial measure.

5. Show by diagrams that triangles upon the same base and with equal altitudes are equal.

6. What is the length in inches of the edges of a cube a yard square?

7. How many 3-inch cubical blocks will fit into a box the inside dimensions of which are 9 feet, 6 feet, and 3 feet?

8. Explain the terms: *perimeter*, *diagonal*, *altitude*, *circumference*, *radius*, *rectangular*, *volume*, *sphere*, *acute angle*, *plane surface*, and *cylinder*.

9. Distinguish between *capacity* and *volume*.

10. Write neatly and in full the table used by surveyors in measuring land.

11. Draw a diagram representing a township. Mark it off into sections and number the sections properly.

12. Whether does a section at the north or at the south of a township contain the most land? Why? Explain fully by diagram.

13. Account for the *double corners* which frequently extend the full length of lines or roads running east and west?

14. Why are *correction lines* necessary in surveying land?

15. Explain the terms: *range*, *principal meridian*, and *base line*.

16. Draw diagrams illustrating the six different kinds of triangles.

17. Prove that the product of the dimensions of a rectangle gives the area.

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GRADED PRACTICAL EXERCISES.

LENGTH AND DISTANCE.

Study the introductory notes carefully before working the exercises.

1. How many inches are there in $2\frac{1}{2}$ rods?

2. How many inches are there in a chain?

3. How many feet are there in 36 chains?

4. How many rods are there in 20 leagues?

5. A horse is $14\frac{1}{2}$ hands high; how many inches high is he?

A hand equals 4 inches.

6. How many links are there in 1,760 yards?

7. A harbor has an average depth of $4\frac{2}{3}$ fathoms; how many feet deep is it?

A fathom equals 6 feet.

8. What is the cost of a cable 1,230 feet long at 95 cents per yard?

9. The hold of a vessel is 30 feet deep, and her topmast is 90 feet high. If she sinks in 16 fathoms of water, how much of her rigging will be visible?

10. What is the cost of 35 miles of telephone wire at 40 cents a pound, supposing a pound to stretch 20 feet?

11. Find the cost of 80 rods of barbed wire fencing of five wires, at 2 cents per yard.

12. What will it cost to survey 36 miles of railway at $\$1.12\frac{1}{2}$ per chain?

13. How many steps, each 30 inches long, will a man take in walking 5 furlongs?

14. The large wheel of a bicycle is 12 feet in circumference. How many revolutions will it make in going 12 miles?

15. Find the cost of carpeting a stairway of 24 steps, each 12 inches wide, and having a rise of 8 inches, allowing 2 feet extra for the projection of the steps, the carpet costing $\$1.25$ per yard.

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16. Find the cost of a spool of ribbon containing 100 feet at 33 cents a yard.

17. How many telegraph poles placed 60 yards apart will be required in 75 miles?

18. Find the total length in feet of:

1. 180 rods, 22 yards, 3 miles.
2. 55 inches, 16 hands, 8½ fathoms.
3. 12 chains, 3 leagues, 150 links.

19. If 2-inch pickets are placed 2 inches apart, how many pickets will be required for a fence half a mile long?

20. How many posts are required for 1 mile of fence at the rate of 11 posts for a chain?

AREA.

21. How many square inches are there in a square yard?

22. How many square feet are there in a square chain?

23. How many square yards are there in 100 square chains?

24. Find the cost of 20 square rods of sodding at 3 cents per square foot.

25. Find the cost of 216¼ yards of cloth at $1.16 per yard.

26. Find the cost of a square mile of prairie land at $3.25 per acre.

27. What will 3,200 square rods of land cost at $1.25 per square chain?

28. How many garden plots, each containing 15 square yards, can be made out of a half-acre lot, allowing one-fourth of the lot for walks?

29. How many pieces of paper, each 3 inches wide and 4 inches long, can be cut from a sheet 12 inches square?

30. How many square feet are there in the surface of a floor 12 feet long and 9 feet wide?

31. How many square inches are there in the surface of a board 12 feet by 1¾ feet?

32. How many square yards are there in a rectangular plot 27 feet long and 4½ feet wide?

33. A field in the form of a rectangle is 15 chains long and 40 rods wide; how many acres does it contain?

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34. Find the cost of waxing a floor 24 feet long by 12 feet 9 inches wide, at 75 cents per square yard.

35. What will it cost to sod a lawn 120 yards long by 75 feet wide, at 9 cents per square yard?

36. How many yards of cotton $1\frac{1}{4}$ yards wide will it take to line 15 yards of cloth $\frac{3}{4}$ of a yard wide?

37. A rectangular field contains 20 acres and is 50 rods wide; how long is it?

38. At $12\frac{1}{2}$ cents per yard, what will it cost to fence a rectangular field of 12 acres, if it is 30 yards wide?

39. The perimeter of a rectangle is 400 feet. The difference between the length and breadth is 40 feet. Find the area.

40. How many bricks, each 9 inches by $4\frac{1}{2}$ inches, will be required to pave the floor of a basement 36 feet by $27\frac{1}{2}$ feet?

VOLUME.

41. How many shovelfuls of earth, each containing 16 cubic inches, are there in a cubic yard?

A cubic yard of earth is called a *load*.

42. How many cubic inches are there in 5 cubic yards?

43. How many cubic inches are there in a cube whose edge is 4 feet?

The lines which bound the sides are called the edges of the cube.

44. What is the volume of a solid 6 feet 3 inches long, 4 feet 6 inches wide, and 8 feet high?

45. How many cubic yards of earth will be removed by digging a cellar 12 feet long, 10 feet wide, and $5\frac{2}{3}$ feet deep?

46. How many cubic feet of air will a room 14 feet long, 12 feet wide, and 10 feet high contain?

47. What will it cost to dig a cellar 16 feet long, 12 feet wide, and $3\frac{3}{4}$ feet deep, at 75 cents per cubic yard?

48. If 3,000 cubical blocks, the edge of each of which is 2 inches, be piled on a board 15 inches by 10 inches, how high will the pile be?

49. If a block of stone 5 inches long, 3 inches wide, and 2 inches high weighs 44 ounces, what will be the weight in pounds of a cubical block of stone whose edge is $2\frac{1}{2}$ feet?

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50. How many stones, each 10 inches by 8 inches by 6 inches, will it take to build a wall 40 rods long, 6 feet high, and $2\frac{1}{2}$ feet thick?

51. What weight of water will a rectangular tank contain, the length being 8 feet, breadth $5\frac{1}{2}$ feet, and depth 7 feet?

A cubic foot of water weighs $62\frac{1}{2}$ pounds.

52. How many loads of gravel will be required for a road 3 miles long, if it is spread 9 feet wide and 8 inches deep?

53. How many loads of sifted gravel are required for a roof 48 feet by 45 feet, if it is spread $\frac{3}{4}$ of an inch thick?

WOOD MEASUREMENT.

54. How many cubic feet are there in a pile of wood 8 feet long, 4 feet wide, and 4 feet high?

55. How many cubic inches are there in two cords of wood?

56. How many cords of wood are there in a pile 16 feet long, 12 feet wide, and 6 feet high?

57. How many cords of wood are there in a pile 80 feet long, 20 feet wide, and 12 feet high?

58. How many cords are there in a pile 100 feet long, 4 feet wide, and 5 feet high?

59. What is the value of a pile of wood 120 feet long, 16 feet wide, and 8 feet high, at \$4.50 per cord?

60. What is the value of a pile of tan-bark 120 feet long, 36 feet wide, and 12 feet high, at \$6.10 per cord?

61. A sleigh upon which four-foot wood is piled is 12 feet long. How high should the wood be piled to make $1\frac{1}{2}$ cords?

62. What is the length of a cord of two-foot wood piled 6 feet high?

63. A cord of 27-inch wood is 16 feet long; how high is it?

64. How many cords of wood can be piled into a woodshed 24 feet long, 16 feet wide, and 10 feet high?

65. A wagon is 12 feet long and $3\frac{1}{2}$ feet wide; how high must wood be built upon it to make $1\frac{1}{2}$ cords?

66. How long must be a pile of tan-bark which is 12 feet high and 10 feet wide, that it may contain 600 cords?

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LAND MEASUREMENT.

67. How many garden beds 8 feet by $5\frac{1}{2}$ feet can be made out of a garden 20 yards by 22 feet?

68. How many 10-acre fields can be made out of a block of land 2 miles long and $1\frac{1}{2}$ miles wide?

69. How many acres are there in a township of public land?

70. How many acres of land are there in a half-section?

71. How many acres of land are there in a half-quarter-section?

72. What are the dimensions in rods of a quarter-section of land?

73. What is the value of a township of land at the rate of $80 for each half-section?

74. How many half-sections are there in a piece of land 12 miles long by 8 miles broad?

75. Find the value of a tract of land 90 miles square at $33\frac{1}{3}$ cents per acre.

76. How many acres are there in a rectangular piece of land 60 rods by 36 rods?

77. How many acres are there in the right-angled triangle formed by joining the opposite angles of a rectangular field 40 rods long and 25 rods wide?

78. Find the area of a right-angled triangle whose base is 60 rods and perpendicular 20 chains.

79. How many acres are there in a field in the form of a right-angled triangle, the sides of which are 300 yards and 1,100 yards?

80. If a man walks $\frac{3}{4}$ of a mile due north, then $1\frac{1}{2}$ miles due west, then in a straight line to the point of starting, around how many acres has he walked?

81. How many acres are there in a triangular field whose base is 80 rods and altitude 30 rods?

82. How many acres are there in a triangular field whose base is 20 chains and altitude 15 chains?

83. How many acres are there in a rectangular piece of land 3 chains 25 links, by 6 chains 50 links?

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84. How much will it cost to sod a triangular plot of ground whose base is 100 feet and altitude 33 feet, at 15 cents per square yard?

85. A triangular field whose base is 80 rods contains 25 acres. What will it cost at 65 cents a rod to build the shortest fence from the vertex to the base?

86. A half-section of land is in the form of a right-angled triangle one of whose sides is half a mile long. What will it cost to fence the other side at $1 per rod?

87. From a lot 40 rods square I sold 40 square rods. What is the value of the remainder at $120 per acre?

88. A triangular field of 40 acres, whose base is 160 rods, is divided into two parts by a fence from the vertex, perpendicular to the base. Find the cost of the fence at 50 cents a rod.

89. A garden in the form of a right-angled triangle is 80 feet by 60 feet. I wish to take from it a walk 12 feet wide along the perpendicular sides. Find the cost of paving the walk at 40 cents per square yard.

LUMBER MEASUREMENT.

90. How many square feet are there in the surface of a board 16 feet by 9 inches?

91. How many feet of lumber are there in a board 12 feet long, 6 inches wide, and 1 inch thick?

To find the number of feet in a piece of lumber, multiply the length in feet by the width and thickness in inches and divide the product by 12.

92. How many feet of lumber are there in a board:

1. 12 feet long, 12 inches wide, and 1 inch thick?
2. 16 feet long, 9 inches wide, and 1 inch thick?
3. 20 feet long, 6 inches wide, and 1 inch thick?

93. Find the number of feet of lumber in a plank 16 feet long, 14 inches wide, and 2 inches thick.

94. Find the number of feet of lumber in two 16-foot planks whose widths are $10\frac{1}{4}$ inches and $5\frac{7}{8}$ inches, and which are 2 and 3 inches thick respectively.

Fractions in the length and width are to be omitted and the nearest integer taken.

95. Find the number of board feet in a plank:

1. 12 feet long, 8 inches wide, and $2\frac{1}{2}$ inches thick.
2. 14 feet long, 14 inches wide, and $1\frac{1}{2}$ inches thick.

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96. How much inch lumber will lay a floor 16 feet by 20 feet?

97. How many feet of lumber in a stick of timber 16 feet long, and 9 inches square?

98. How many feet of lumber in a sidewalk 160 yards long, 8 feet wide, and $1\frac{1}{2}$ inches thick?

99. How many feet of lumber in 40 pieces of siding, each 12 feet long, 6 inches wide, and half an inch thick?

All lumber less than 1 inch in thickness is considered inch lumber in measuring.

100. How many feet of lumber in the following bill?

24 joists 18 feet by 10 inches, and 2 inches thick;
4 beams 20 feet long and 9 inches square;
200 pieces of siding 12 feet long and 4 inches wide.

101. How much lumber is there in 40 two-by-four scantlings each 12 feet long?

102. Find the cost of 1,274 feet of lumber at \$18 per thousand.

103. Find the cost of the $1\frac{1}{4}$-inch flooring required to lay a floor 40 feet by 26 feet, at \$22 per thousand.

104. Find the cost of 20 planks, each 16 feet long, 10 inches wide, and $2\frac{1}{2}$ inches thick, at \$15 per thousand.

105. Find the cost of the inch lumber in a tight board fence, 40 rods long, and 6 feet high, at \$10 per thousand feet.

106. Find the cost of an inch-board sidewalk, 4 feet wide, around the outside of a garden 200 yards by 90 feet, at \$12 per M.

107. A feeding floor, 40 feet long, is laid with 16-foot planks $2\frac{1}{2}$ inches thick. Find the cost at \$11 per thousand.

108. Find the cost of laying a bridge 210 yards long and 18 feet wide with 3-inch planks, at \$16 per thousand.

109. What is the cost of 576 fence boards, 16 feet long and 9 inches wide, at \$14 per thousand?

110. At \$22 per thousand find the total cost of:

33 10-inch shelving boards, 14 feet by $\frac{7}{8}$ inches thick.
90 pieces 6-inch matched inch flooring, 12 feet long.
44 dressed two-by-six scantlings, 16 feet long.

111. If two-by-four studs are used, and they are placed 16 inches apart, how many feet of lumber are there in the studding of a wall 20 feet long and 12 feet high?

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112. If 4×5 rafters are used, and they are placed 30 inches apart, how many feet of lumber are there in the 20-foot rafters of a double-roof 40 feet long?

113. If 10-inch lumber is used for sheeting the roof in No. 112, and the boards are placed 2 inches apart, allowing for a projection of 1 foot at each end, what will be the number of feet of boards required?

114. How many feet of lumber are there in the 12-inch baseboard and 2×4 scantlings for a picket fence around a quarter-acre lot with 33 feet frontage?

STONE-WORK.

115. How many cubic feet of stone are there in a pile 40 feet long, 8 feet wide, and 3 feet high?

116. How many cubic feet of stone will fill a wagon-box 10 feet long, $3\frac{1}{2}$ feet wide, and 1 foot deep?

117. How many cords of stone are there in a pile 24 feet long, 16 feet wide, and 3 feet high?

A cord of stone is the same size as a cord of wood. In estimating stone-work, no smaller part than quarter-cords is allowed.

118. How many cubic feet of wall can be laid with $7\frac{1}{2}$ cords of stone?

A cord of stone makes 100 cubic feet of wall.

119. How many cords of stone will build a wall 200 feet long, 12 feet wide, and 3 feet thick?

120. How many cords of stone will build a wall 50 yards long, 6 feet high, and 18 inches thick?

121. Find the cost of the stone in a wall 36 feet long, 8 feet high, and 18 inches thick, at $7 per cord.

122. How many cords of stone are required for a cellar 24 feet by 16 feet, and 9 feet high, if the walls are 2 feet thick?

In estimating the amount of stone or the cost of the mason-work, it is customary to measure around the outside of the wall, and make no allowance for openings unless they are large.

123. How many cords of stone are required for a wall under a building 30 feet by 40 feet, the wall being 6 feet high and 20 inches thick?

124. At $6 per cord, what is the cost of the stone for the basement of a house which measures 160 feet around the outside, the wall being 8 feet high and 20 inches thick?

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125. How much lime and sand will be required for the mortar of an 18-inch wall 8 feet high, under a house 33 feet by 17 feet?

Three bushels of lime and a cubic yard of sand will lay a cord of stone.

126. Find the cost of the material in No. 125, if the stone costs $5 per cord, the lime 33 cents per bushel, and the sand $1.25 per cubic yard.

127. How many perches of stone-work are there in a wall 165 feet long, 10 feet high, and 18 inches thick?

A *perch* of stone-work is 16½ feet long, 1½ feet thick, and 1 foot high; it contains 24¾ cubic feet.

128. Find the cost of putting up the wall in No. 125, at 65 cents a perch.

A part of a perch is reckoned a whole one by stone-masons.

129. Find the cost of a two-foot wall, 9 feet high, under a house 37½ feet by 45 feet, at $1.25 a rod.

130. A stone house is 36 feet by 24 feet. How many perches of mason-work are there in the basement walls, if they are 24 inches thick and 9 feet high?

131. How many perches are there in the walls of the ground floor in No. 130, if they are 18 inches thick and 12 feet between the floors?

132. How many perches are there in the walls of the second floor and the gables in No. 130, if the ceiling be 8 feet and the gables 7 feet high, the wall being 12 inches thick?

133. Find the cost of the stone-work in the entire house in No. 130 at $1.12½ a perch.

BRICK-WORK.

134. How many bricks laid close will make 1 cubic foot?

135. A pile of ordinary bricks is 8 feet 6 inches high, 14 feet long, and 15 feet wide. What is the pile worth at $12.50 a thousand?

136. How many bricks are there in a wall 36 feet long, 12 feet high, and half a brick thick?

137. How many bricks are required to veneer the front of a house 18 feet wide and 25 feet high?

138. How many bricks are required for the single brick partition between two houses 40 feet deep and 25 feet high?

In *single brick* walls each brick has a surface of 4½ inches by 3 inches, or a brick is required for each 14 inches of surface.

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139. How many bricks are required to build a house 30 feet by 20 feet, and 16 feet high, with single brick walls?

140. How many bricks are required for a double brick wall 80 feet long and 8 feet high?

In *double brick* walls a brick is required for each 7 inches of surface.

141. How many bricks are required for the double brick wall of a basement 40 feet by 51 feet, and 10 feet high?

It is customary to count the corners twice and the half of large openings.

142. What will it cost to lay the brick of a house 36 feet by 30 feet, and 21 feet high, with a flat roof and double walls, at $2.75 per thousand?

143. Find the cost of the brick in the wall around a garden 100 feet by 45 feet, the wall being 6 feet high and a brick and a half thick, at $7 per thousand.

Reckon that each brick has a surface of 10 inches.

144. The front wall of a terrace is 120 feet long and 20 feet high. There are 6 doors, each 8 feet by $3\frac{1}{2}$ feet, and 18 windows, each 8 feet by 4 feet. Find the cost of the brick required at $9 per thousand, the wall being $1\frac{1}{2}$ bricks thick.

145. I am building a house 40 feet by 30 feet. How many bricks will be required for the basement, the walls of which are 8 feet high and two bricks thick, allowing for a door 4 feet by 6 feet?

146. How many bricks are required for the walls of the ground floor in No. 145, if it is 11 feet between floors, and the walls a brick and a half thick? Allow for 2 doors and 4 windows, each $8\frac{1}{2}$ feet by 4 feet.

147. How many bricks will build the walls of the top floor and gables in No. 145, the ceiling being 8 feet and the gables 10 feet high, and the wall one brick thick? Allow for 6 windows, each 8 feet by $3\frac{1}{2}$ feet.

148. How many bricks are required to lay one course of a chimney, the flue of which is $8\frac{1}{2}$ inches by 4 inches?

In ordinary chimneys each brick is laid on its broadest face and the walls are 4 inches thick.

149. How many bricks are required for one course of a chimney, the flue of which is 9 inches square?

150. If a brick with mortar is 3 inches thick, how many bricks are required for a chimney 12 feet high with 9-inch flue?

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CARPENTERS' WORK.

151. How many feet of $1\frac{1}{4}$-inch flooring are required for a veranda around three sides of a house 40 feet long and 24 feet wide, if the veranda is 8 feet wide?

152. How many 12-foot strips 2 inches wide will lay a walk 4 feet wide and 40 yards long, allowing $\frac{1}{2}$ an inch between the strips?

153. Find the cost of the lumber in the two floors of a house 18 feet by 24 feet, if the lower floor is $1\frac{1}{2}$ inches thick, and the upper floor 1 inch thick, at \$22 per M.

154. How many 12-foot matched 6-inch boards are required to put a 3-foot wainscot around a kitchen 12 feet by 16 feet, allowing for 2 doors, each $3\frac{1}{2}$ feet wide?

155. How many feet of lumber are there in the two-by-four studs of a partition wall 16 feet long and 12 feet high?

The studs of partition walls are placed 16 inches apart from centre to centre.

156. A barn is 60 feet long, 40 feet wide, and 20 feet high; the gables are 8 feet high, and the rafters 21 feet long. Find the number of feet of inch boards in the 2 sides, allowing for 4 double doors 12 feet by 16 feet.

157. In No. 156, find the number of feet of lumber in the ends and gables.

158. In No. 156, find the number of feet of lumber required to sheet the roof.

159. In No. 156, find the cost of the matched lumber for the doors at \$18 per M.

160. In No. 156, how many feet of 2-inch plank are required for the floor 24 feet wide?

161. In No. 156, how many feet of lumber are there in the sills 10 inches square?

The corners must be counted twice to allow for mortise.

162. In No. 156, how many feet of lumber are there in the 12 posts of the barn if they are 8 inches square?

163. In No. 156, if the rafters are 4 inches by 4 inches, and are placed 2 feet 6 inches apart, what is their value at \$10 per M?

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164. Find the cost of the lumber for the dressed door-facings of 15 doors, each 7 feet high and 2 feet 8 inches wide, the facings being 6 inches wide, at $18 per thousand feet.

165. How many feet of moulding are required for the facings of the doors in No. 164?

166. Find the cost of the material for 12 door-frames made 6 inches deep out of 1½-inch plank, 12 inches wide, the frames being 8 feet by 3½ feet; lumber at $20 per thousand.

SHINGLES.

167. How many shingles are there in 17 bunches?

168. How many bunches of shingles are there in 12½ thousand?

169. How many thousand shingles are there in 18 bunches?

170. How many square inches are covered by the exposed part of every shingle?

171. How many shingles will cover one square foot?

172. How many shingles are required for a roof with an area of 1,250 square feet?

173. How many bunches of shingles will lay a single roof 40 feet by 30 feet?

174. How many bunches of shingles are required for a double roof 24 feet long, with 20-foot rafters?

Dealers will not sell parts of bunches.

175. Find the cost of laying a double roof 50 feet long, rafters 24 feet long, with shingles 4 inches to the weather, at $3.60 per thousand?

176. How many bunches of shingles are required for a double roof 36 feet long, rafters 21 feet, the shingles being laid 4½ inches to the weather?

Laid 4½ inches to the weather, 900 shingles are required for 100 square feet.

177. At $3.75 per thousand, find the cost of the roof in No. 176.

178. How many metallic shingles are required for a double roof 45 feet by 27 feet, if each shingle covers 18 square inches?

179. A roof is 36 feet long and 25 feet wide; find the difference in cost between a pitch and gravel roof at 35 cents per square yard, and a shingle roof at $3.25 per thousand.

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LATHS.

180. Including one of the spaces between the laths, how many square inches does one lath cover?

181. How many laths will cover one square yard?

182. How many square feet will a bunch of laths cover?

183. How many bunches of laths will cover a wall 45 feet long and 12 feet high?

Allowing for waste, contractors reckon that a bunch of laths will cover 3 square yards.

184. How many bunches of laths will cover the ceiling of a room 40 feet by 24 feet?

185. How many bunches of laths are required for the sides and ceiling of a room 12 feet by 15 feet and 9 feet high?

186. How many bunches of laths are required for a hall 80 feet long, 54 feet wide, and 25 feet high, allowing for 10 doors and windows, each 12 feet by 6 feet?

Only one-half of the surface of openings is to be deducted.

187. At 30 cents a bunch, find the cost of the laths required for a room 18 feet by 24 feet and 12 feet high, there being 3 windows and 2 doors, each 8 feet by 4 feet.

188. At 25 cents a bunch, find the cost of the laths required for a room 26 feet by 12 feet and 10 feet high, allowing for a door 8 feet by $3\frac{1}{2}$ feet, and a window 7 feet by 4 feet.

189. A summer-house in the form of an octagon, of which one side is left for doorway, is enclosed with laths placed 1 inch apart, across each other. Find the amount of laths required, the house being 8 feet high and each side 3 feet long.

PLASTERING.

190. How many square yards of plastering are there in the ceiling of a room 60 feet long and 24 feet wide?

191. How many square yards of plastering are there in the walls of a room 36 feet by 24 feet and 10 feet high?

192. How many square yards of plastering are there in the walls and ceiling of a room 32 feet by 24 feet and 12 feet high?

193. Allowing for an 18-inch base board, find the number of yards of plastering in a room 34 feet by 27 feet and 14 feet high.

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194. Find the cost of plastering a ceiling 24 feet by 18 feet, at 9 cents per square yard.

195. Find the cost of plastering a wall 54 feet long and 18 feet high, at 22½ cents per square yard.

196. Find the cost of plastering the walls of a room 18 feet by 24 feet and 14 feet high, at 25 cents a yard.

197. At 12½ cents per square yard, find the cost of plastering the walls of the rooms:

1. 21 feet long, 15 feet wide, 10 feet high.
2. 18 feet long, 15 feet wide, 9½ feet high.
3. 36 feet long, 24 feet wide, 15 feet high.

198. Find the cost of plastering the walls and ceiling of a room 21 feet long, 12 feet wide, and 9 feet high, with 4 openings, each 8 feet by 4 feet, at 12 cents per square yard.

Half the surface of openings is allowed for in plastering.

199. Find the cost of plastering a room 24 feet by 14 feet and 12 feet high, with 18-inch base, and having 4 openings averaging 25 square feet each, at 15 cents per square yard.

200. Find the cost of lathing and plastering a ceiling 24 feet by 30 feet, the laths costing 40 cents a bunch, and the plastering 15 cents a square yard.

201. Find the cost of lathing and plastering a room 12 feet by 14 feet and 9 feet high, with laths at 30 cents a bunch, and plaster at 10 cents a square yard.

202. Find the cost of cementing the sides and bottom of a cistern 8 feet by 12 feet and 9 feet high, at 8 cents per square foot.

PAINTING.

203. How many square yards of painting are there in a floor 36 feet by 24 feet?

204. What will it cost to paint a floor 32 feet by 28 feet, at 25 cents per square yard?

205. What will it cost to paint a close board fence, 6 feet high, around a lot 36 yards by 32 yards, at 12 cents per square yard?

206. What will it cost to paint a house 36 feet by 24 feet, which averages 18 feet high, at 20 cents per square yard?

207. What will it cost to paint the roof of a house 34 feet long, rafters 18 feet, at 32 cents per yard?

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208. Find the cost of kalsomining the ceiling of a hall 80 feet long and 36 feet wide, at 18 cents a yard.

209. What will it cost to kalsomine a room 26 feet by 14 feet and $9\frac{1}{2}$ feet high, at 7 cents a yard?

210. What will it cost to tuckpoint the front of a brick house 36 feet long and 24 feet high, allowing for half the openings, which form one-fourth of the surface, at $\$1.75$ per square yard?

211. What will it cost to paint a double roof 44 feet by 27 feet, at $12\frac{1}{2}$ cents a yard?

212. How much white lead paint is required for one coat on a fence 200 yards long and 6 feet high, if a pound covers $4\frac{1}{4}$ square yards?

213. How many pounds of Venetian red paint will cover the front of a brick house 30 feet wide and 18 feet high, allowing for 6 openings 8 feet by $3\frac{1}{2}$ feet, if one pound covers $2\frac{2}{3}$ yards of bricks?

PAPERING.

214. How many strips of paper will go around a room 18 feet by 24 feet?

215. How many strips of paper are required for a room 30 feet by 24 feet, if there are 4 windows and 2 doors?

216. How many strips are required for a room 14 feet by 12 feet, with 1 window and 1 door?

217. How many strips are required for a hall 24 feet long and 6 feet wide, papering the sides only, in which are 4 doors?

218. If the ceiling be 12 feet high with a cornice, how many strips can be cut from a double roll?

One foot may be deducted for the ordinary deep cornice, no allowance being made for the base owing to the waste in matching the figure.

219. How many rolls will paper a ceiling 24 feet by 18 feet?

220. How many double rolls are required for a wall 21 feet long and 13 feet high, with a cornice?

221. How many rolls will paper a room 12 feet by 16 feet and 8 feet high, allowing for 1 door and 1 window?

222. How many double rolls are required for a room 16 feet by 9 feet and 10 feet high, with 2 windows and 1 door?

223. Find the cost of papering a room 18 feet by 12 feet and 9 feet high — 3 openings — at 36 cents per double roll?

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224. Find the cost of the paper for a room 36 feet by 24 feet and 14 feet high, with cornice and 2-foot wainscot, at 50 cents per double roll.

225. Find the cost of papering a room 22 feet by 16 feet, 14 feet high, with cornice, 1 double window and 2 doors, at 65 cents per double roll.

226. Find the cost of paper for a hall 72 feet by 44 feet, 14 feet high below the cornice, allowing for 8 windows and 2 doors; the paper costing 45 cents per double roll.

227. If the border costs 5 cents a yard, and the paper 60 cents a double roll, find the cost of papering a room 27 feet by 18 feet and 9 feet high, with 3 openings.

228. With paper at 10 cents a roll, and border at 2 cents a yard, find the cost of paper and border for a room 12 feet by 14 feet and 9 feet high, with 2 openings.

229. With paper at $12\frac{1}{2}$ cents a roll, and border at 3 cents a yard, what is the cost of paper and border for a room 24 feet by 20 feet and $12\frac{1}{2}$ feet high, with cornice — there being 2 double windows and 2 doors?

230. If the paper-hanger charges \$2, the border costs 4 cents a yard, and the paper 45 cents a double roll, find the cost of papering a room 22 feet by 14 feet and $12\frac{1}{2}$ feet high, with cornice, 1 double and 1 single window, and 2 doors?

231. Find the cost of papering the walls of a room 36 feet by 20 feet to the height of $3\frac{1}{2}$ feet, at 65 cents per double roll; the border costing 7 cents per yard.

FURNISHING.

232. A gilt moulding at 10 cents a foot is placed around a drawing room 36 feet by 18 feet. Find the cost.

233. Two strips of moulding at $12\frac{1}{2}$ cents a foot are placed around a drawing room 24 feet by 16 feet. Find the cost.

234. A room 26 feet 3 inches long and 16 feet 6 inches wide is to be covered with carpet 1 yard wide. Which way of the room should the "breadths" run that there may be the least turned under or cut off from one side of a breadth?

235. In No. 234, if the "breadths" were 16 feet 6 inches long, how many "breadths" would be required?

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236. In No. 234, if the "breadths" were 26 feet 3 inches long, how many would be required?

237. In No. 234, if the "breadths" were 16 feet 6 inches long, and there was no waste in matching, how many yards would it take?

238. In No. 234, if the "breadths" were 26 feet 3 inches long, and there was no waste in matching, how many yards would it take?

239. A room is 15 feet by 17 feet 6 inches and the carpet is $\frac{3}{4}$ of a yard wide. What must be the length of the "breadths" to have the least waste?

240. In No. 239, how many "breadths" will be required?

241. In No. 239, how many yards of carpet would be required if there was a waste of 8 inches in matching each "breadth" except the first?

242. Why should there be no waste in the first breadth?

243. A room is $17\frac{1}{2}$ feet by $25\frac{1}{2}$ feet and the carpet is 1 yard wide. How many yards are required if the "breadths" are $17\frac{1}{2}$ feet long?

244. In No. 243, how many yards are required if the "breadths" are $25\frac{1}{2}$ feet long?

245. Find the cost of carpeting a room 36 feet by 26 feet with carpet 1 yard wide, at \$1.25 per yard.

246. Find the cost of carpeting a room 12 feet by 13 feet with carpet $\frac{3}{4}$ of a yard wide, at 75 cents a yard.

247. A parlor, 20 feet by 17 feet, is carpeted with 36-inch carpet at \$1.20 a yard, surrounded with a carpet border, 1 foot wide, turned under at the corners, at 75 cents a yard. Find the total cost.

248. Find the cost of the carpet for a stair of 17 12-inch steps, each rising 8 inches, at 90 cents a yard.

249. Find the cost of covering the floor of a hall 24 feet by 8 feet with oil-cloth 4 feet wide, and costing 65 cents a yard.

250. Find the cost of the blinds for 8 windows, each 6 feet 9 inches high, at 35 cents a yard.

251. Find the number of yards of curtain required for 8 windows, allowing $3\frac{1}{2}$ yards in length.

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FENCING.

252. How many fence posts are required for a fence 80 rods long if the posts are placed 7 feet apart?

253. How many posts are required for a fence around a field 40 rods square if they are 6 feet apart?

254. Find the cost of the posts for a fence around a garden 250 yards by 220 yards, if the posts are placed 6 feet apart and cost 10 cents each.

255. In No. 254, how many two-by-four scantlings, 12 feet long, will be required for the 2 stringers of the fence?

256. In No. 254, how many 12-foot boards, each 14 inches wide, are required for the base?

257. How many feet of lumber are required for the upright boarding, if a close board fence 4 feet high above the base is placed around the garden in No. 254?

258. At $12 per thousand feet, find the total cost of the lumber used in building the fence in No. 254.

259. How many feet of lumber are required for a 12-inch base board around a field 40 rods by 30 rods?

260. How many two-by-four scantlings, 14 feet long, are required for the 2 stringers around the field in No. 259?

261. How many 2-inch pickets placed 2 inches apart are required for a fence 40 rods long?

262. If $2\frac{1}{2}$-inch pickets are placed 2 inches apart, how many will be required for a fence around a garden 200 yards by 150 feet?

263. How many pickets, each 3 inches wide and placed 2 inches apart, are required to fence a lot 50 feet wide and 30 yards deep?

264. How much lumber is there in 40 rods of common board fencing, consisting of five 6-inch boards?

265. What will it cost for the lumber to fence 5 miles of railway, both sides, with six 6-inch boards at $8 per thousand?

266. What will it cost, at $9 per thousand, to fence a field 40 rods by 60 rods with one 12-inch board and five 6-inch boards?

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267. What will it cost per mile to fence a railway with 5 strands of barbed wire which weights 1 pound per rod, at 8 cents a pound?

268. Find the cost of 40 rods of fence with the posts 8 feet apart, a 12-inch base, a two-by-four rail at the top, and 4 strands of barbed wire; the posts cost 10 cents each, the lumber \$12 per thousand, and the wire 7 cents a pound, which stretches 16½ feet.

CAPACITY.

269. How many cubic feet will 100 bushels of grain occupy?

A bushel is equal to 1¼ cubic feet nearly.

270. How many bushels of oats will a bin 8 feet by 6 feet by 5 feet contain?

271. How many cubic feet of space will be necessary in which to store 600 bushels of corn?

272. A bin is 8 feet by 10 feet; how deep will the wheat be in it when it contains 400 bushels?

273. How many bushels of shelled corn will a wagon-box contain that is 12 feet long, 3 feet wide, and 20 inches deep?

274. How many bushels of potatoes can be stored in a bin 20 feet by 8 feet, and 6 feet deep?

A bushel heaped measure contains about 1¼ cubic feet.

275. How deep must the potatoes be in a wagon-box 10 feet long and 3 feet wide to contain 20 bushels?

276. How many bushels of turnips will a wagon-box contain that is 10 feet long, 3 feet wide, and 22 inches deep?

277. The apples in a bin 12 feet by 4 feet are 3½ feet deep; how many bushels are there?

278. A corn-crib is 8 feet wide, 7 feet high, and 25 feet long; how many bushels of corn will it contain?

A *corn-crib* is used to store unshelled corn. A *bushel of corn* means either a bushel of shelled corn or enough corn in the ear to make a bushel of shelled corn. Two bushels of ear corn will make a bushel of shelled corn.

279. How many cubic feet of space are required to store 2,000 bushels of corn before it is shelled?

280. How deep must be the corn in a crib 100 feet long and 8 feet wide to contain 4,000 bushels?

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281. How many bushels of unshelled corn will a wagon-box 10 feet by 3 feet, and 20 inches deep, contain?

282. How deep is the unshelled corn in a wagon-box 10 feet by 3 feet when it contains 20 bushels?

283. How many bushels of turnips will a pit 20 feet long, 6 feet wide, and 4 feet deep contain?

284. How many barrels of water will a cistern 7 feet square and 9 feet deep contain?

The barrel used in measuring contains about 4½ cubic feet.

285. If a cistern be 8 feet square, how deep must it be made to contain 100 barrels of water?

286. If a gallon contains 230 inches, how deep is the oil in a tank 2 feet square to contain 60 gallons?

287. A school-room 20 feet by 30 feet, and 12 feet high, seats 72 children; how many cubic feet of air are there for each child?

288. How high should the ceiling of a school-room which is 20 feet by 25 feet be to allow 150 cubic feet of air to each of 50 pupils?

289. The ceiling of a school-room is 20 feet high; how many square feet of floor will each of 60 pupils have, allowing each pupil 100 cubic feet of air?

290. A tank 20 yards long and 14 yards broad will hold 1,680 cubic yards of water; find its depth.

291. How many bushels of apples can be stored in a bin 12 feet long, 8 feet wide, and 6 feet deep?

292. How many gallons of water in a 3 by 4 cistern, the water in which is 11 feet deep?

A gallon of water is equal in volume to 231 cubic inches.

293. A school-room in which there are 48 pupils and one teacher is 35 feet by 28 feet, and the ceiling is 12 feet high; making no allowance for furniture, how many cubic feet of air will the room allow for each pupil?

294. If a barrel contains $4\frac{1}{8}$ cubic feet, how many barrels of lime in a pile 30 feet long, 22 feet wide, and 2 feet deep?

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MISCELLANEOUS REVIEW EXERCISES.

295. How many posts are required to enclose a quarter-acre lot of 66 feet frontage if the posts are placed 6 feet apart?

296. How many 2-inch pickets placed 2 inches apart will enclose the lot in No. 290?

297. A box made of 2-inch plank is 3 feet 4 inches long, 2 feet 8 inches wide, and 1 foot 6 inches high. It has no lid. How much will it cost to cover the box completely, inside and outside, with gold leaf at $2 per square foot?

298. How many feet of lumber are there in three $1\frac{1}{4}$-inch 16-foot boards whose breadths are respectively 12 inches, 14 inches, 15 inches?

299. How many feet of lumber are there in 100 pieces of 14-foot siding 6 inches wide?

300. What is the cost per yard of a 6-foot sidewalk of a 2-inch plank at $12 per thousand, laid on 3 stringers 3 inches by 4 inches, costing $10 per thousand?

301. How many miles an hour does a person walk who takes 2 steps a second and 1,800 steps a mile?

302. What length of road 36 feet wide will contain an acre?

303. A railway one chain wide runs across a section of land parallel with one side. Find the price of the land in the railway at $25 per acre.

304. How many sods, each 1 foot 8 inches by 10 inches, will it take to sod a quarter-acre plot?

305. Find the cost of sodding an acre of ground at $12\frac{1}{2}$ cents a square yard.

306. How many lots of $\frac{1}{4}$ of an acre each can be made out of a field 45 chains square, allowing $\frac{1}{4}$ for streets?

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307. A piece of cloth, when measured with a yard measure that is half an inch too short, appears to be 72 yards long. What is its true length?

308. How many square yards are there in the ceiling, walls, and floor of a room 27 feet long, 18 feet wide, and 9 feet high?

309. What will it cost to paint the walls and ceiling of a hall 40 feet long, 25 feet wide, and 18 feet high, at 75 cents a yard?

310. What will it cost to slate the double roof of a house 27 feet long, 15 feet rafters, at $14.50 per square of 100 square feet?

311. What will it cost to plaster the walls and ceiling of a room 18 feet by 24 feet and 12 feet high, at 22 cents per square yard, allowing $\frac{1}{8}$ for openings?

312. How many square feet are there in a walk 3 feet wide, surrounding a rectangular garden 60 feet by 24 feet?

313. The corner field of a farm is 80 rods long and contains 10 acres; what will the road fence around two sides cost, at 45 cents a rod?

314. How many planks, each 10 inches wide and $13\frac{1}{2}$ feet long, will it take to make a sidewalk 200 yards long and $4\frac{1}{2}$ feet wide?

315. If each man occupies a space of 27 inches by 20 inches, how many men can stand in a room 36 feet by 40 feet?

316. How many trees are there in a grove half a mile square, if there are on an average 8 trees to a square chain?

317. A reservoir is 300 yards long and 200 yards wide. How many cubic feet of water must be drawn off to lower the surface 1 inch?

318. How many cords of stone can be put into the hold of a schooner whose capacity is 12,000 cubic feet?

319. A's farm is $2\frac{1}{2}$ miles square, B's is $2\frac{1}{2}$ square miles, C's is $\frac{3}{4}$ of the difference. How many acres has C?

320. A's farm is $\frac{1}{4}$ of a mile square, B's is $\frac{1}{4}$ of a square mile, C's is $\frac{1}{2}$ of the difference. How many acres has C?

321. How many perches of stone-work are there in the wall surrounding a court 120 feet by 150 feet, if the wall is 2 feet thick and 4 feet high?

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322. Find the cost of a pile of lumber 16 feet long, $5\frac{1}{2}$ feet wide, and 16 feet high, at \$18 per thousand.

323. A contractor undertakes to dig a ditch $3\frac{1}{2}$ miles long, 12 feet wide at the top, 6 feet wide at the bottom, and 12 feet deep, at 18 cents per cubic yard. How much does he receive for the work?

The average width is 9 feet.

324. How many 8-inch furrows must be ploughed across a square 10-acre field to make an acre?

Each side of a square 10-acre field is 40 rods.

325. A map is drawn on the scale of 12 miles to an inch, and a county is represented on it by a rectangle $2\frac{1}{2}$ inches by $1\frac{1}{2}$ inches. How many sections are there in the county?

326. If the scale on a map is 4 miles to the inch, how many acres are there in a township which is represented by a square whose side is $1\frac{3}{4}$ inches?

327. How deep must a lot be to contain $\frac{1}{3}$ of an acre, if it is 88 feet wide?

328. Trees are planted 12 feet apart around the sides of a rectangular field 40 rods long, containing 2 acres. How many trees are there?

329. A square yard is cut from a board 18 feet long and 10 inches wide. Find the length of the remainder.

330. A boy takes 924 steps of $2\frac{1}{2}$ feet each to walk around a field 40 rods long. How many acres are there in the field?

331. A farmer has a bin 18 feet long, 10 feet wide, and 6 feet deep, that is $\frac{3}{4}$ full of wheat. What is it worth at \$2 per bushel?

332. A gallon of paint, worth \$1.75, covers 200 square feet. What will it cost to paint, with one coat, a tight board fence 4 feet high, which encloses a lot 8 rods by 22 rods?

333. How many bushels of apples will a bin 18 feet long, 6 feet wide, and 4 feet deep contain?

334. How many square yards of block pavement are there in a street $\frac{3}{4}$ of a mile long and $1\frac{1}{3}$ chains wide?

335. Each side of a barn roof is 60 feet by 24 feet. The roof is covered with 8-inch boards laid 2 inches apart. How many feet of lumber are there in the covering?

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336. How far does a team travel in mowing 10 acres, the width of the cut being $3\frac{1}{2}$ feet?

337. If the rows in a potato field are 3 feet apart, how many rods of rows will make an acre?

338. A farm consists of the northeast quarter and the north half of the southeast quarter of section 22. How many acres are there in the farm?

339. I have siding enough to cover my house if I lay it 4 inches to the weather; what part of it will be left if I lay it 5 inches to the weather?

340. Find the surface of a cube each of whose edges is 5 feet 5 inches in length.

341. Find the value of $1\frac{1}{2}$-inch plank, at \$24 per thousand, that will be needed to make a land-roller whose circumference is 15 feet and length 12 feet.

342. A board fence with posts 7 feet apart is built with one 10-inch, one 8-inch, and three 6-inch boards. Find the value of sufficient 14-foot lumber to build 40 rods of the fence at \$11 per thousand.

343. A rectangular field 70 rods long contains 28 acres. Find its width.

344. How many square feet of surface are there in a beam 40 feet long and 16 inches square?

345. A stick of timber 2 feet square and 16 feet long is sawed into inch lumber. How many feet will it make, $\frac{1}{8}$ being lost in sawing?

346. A newly surveyed township in the form of a square contains 36 sections of land. It is separated from the adjoining townships by roads 4 rods wide, and it has roads of the same width separating the sections. Reckoning half the boundary road, how many acres of roads are there in the township?

347. A ditch 10 feet wide at the top and 6 feet wide at the bottom is dug 4 feet deep. Find the quantity of earth thrown out for each rod of length.

348. A field in the form of a rectangle, one side of which is $2\frac{1}{2}$ times the other, contains 25 acres. Find the shorter side.

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349. Into a cubical box 4 feet each way is put another cubical box 3 feet each way. Find the amount of unoccupied space, neglecting the thickness of the boxes.

350. What will it cost, at 40 cents a rod, to enclose and divide into 40-acre fields, with a wire fence, a quarter-section of land?

351. A map of a township is drawn on a scale of 6 inches to the mile. The map is $3\frac{1}{2}$ feet by 2 feet. How many acres are there in the township?

352. Find the number of rails, each 12 feet long, required to build a straight rail fence, 6 rails high, around a square 10-acre field, allowing the rails to overlap 1 foot.

353. A plate of gold 4 inches square and $\frac{6}{8}$ of an inch thick is extended by hammering so as to cover a surface of 12 yards square; find its proper thickness.

354. A room whose height is 11 feet takes 143 yards of paper 2 feet wide for its four walls; how many feet of gilt moulding will be required to go around the room?

355. Find the cost of making a road 108 yards in length at 20 feet wide; the soil being first excavated to the depth of 1 foot at a cost of 25 cents per yard; rubble being then laid 8 inches deep at 20 cents per cubic yard, and gravel placed on the top, 9 inches thick, at 45 cents per cubic yard.

356. The distance between two wickets was marked out for 22 yards, but the yard measure was $\frac{5}{12}$ of an inch too short. What was the actual distance?

357. Find the cost of paving a walk 6 feet wide around a rectangular garden 60 yards by 40 yards, and two walks each 4 feet wide through the middle at right angles to each other and parallel to the sides, at $12\frac{1}{2}$ cents a square yard.

358. If a ton of coal occupies 40 cubic feet, what will it cost to fill a bin 12 feet long, 6 feet wide, and 5 feet deep, with coal at $6.50 a ton?

359. In an orchard 100 yards by 200 yards the trees are 20 feet apart and 20 feet from the fence; how many trees are there?

360. In No. 359, if the trees are placed 25 feet apart and $12\frac{1}{2}$ feet from the fence, how many trees are there?

361. How many inches in width must a lumber dealer measure off in measuring 14-foot lumber, $1\frac{1}{2}$ inches thick, to make 2,170 feet?

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362. If a pint contains $28\frac{7}{8}$ cubic inches, how many pints of water are there in a tank 11 feet by 7 feet and 3 feet deep, filled to the top?

363. How many cubical blocks $\frac{1}{4}$ of an inch on each edge can be built into a cubical box 2 inches deep, 2 inches wide, and 2 inches long?

364. How high must wood be piled on a car 36 feet long and 8 feet wide to contain 16 cords?

365. A regiment of 992 men is drawn up in the form of a hollow square 4 deep. How many men are there on each side?

366. A tank is 8 feet by 5 feet 4 inches by 4 feet 6 inches. How many gallons will it hold if a cubic foot weighs 1,000 ounces and a pint of water weighs a pound and a quarter?

367. An 18-acre field, the length of which is 80 rods, is turned over in 9-inch furrows. What distance does the ploughman walk in ploughing it?

368. A barn is 40 feet by 24 feet and has a quarter-pitch roof. How many feet of lumber are there in the gables?

A roof is said to be quarter pitch when the height of the roof is one-fourth of the width of the building.

369. How much lumber is there in one gable of a barn 30 feet wide, if the roof be third-pitch?

370. Starting from Chicago, I go 200 miles due west, then 150 miles due north, then 100 miles due east, then 350 miles due south, then 100 miles due east, then 150 miles due north. How far from Chicago am I now? What direction from the city am I?

371. Two-foot wood is piled to the height of 6 feet. How long must the pile be to contain 3 cords?

372. At the rate of $124\frac{1}{2}$ rods a minute, how many hours will a train be in going from Boston to Buffalo, a distance of 498 miles?

373. A rectangular cistern, 12 feet by $8\frac{1}{2}$ feet, and 6 feet deep, is lined on the sides and bottom with copper, at 75 cents per square foot; what is the cost of the lining?

374. How many more yards of fence will it take to fence a 10-acre field which is 80 rods long, than to fence a square 10-acre field?

375. Find the area in acres of a triangle whose base is 80 rods and altitude 35 rods.

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TEST AND EXAMINATION EXERCISES.

Many of the exercises which follow are of a mathematical character, and cannot be solved without a knowledge of geometry and of square root. They are not given as part of this book, but rather as a necessary supplement to the book.

376. A square lawn contains 11,664 square yards. What will it cost to fence it at $1.25 a yard?

377. A square bin 7 feet deep has a capacity of 5,103 cubic feet. What is its length?

378. A garden contains 1,875 square yards, and it is three times as long as it is broad. Find its length and breadth.

379. How long must the side of a square lot be to contain $2\frac{1}{2}$ acres?

380. The sides forming the right angle of a right-angled triangle are 27 and 36. What is the hypothenuse?

381. Circleville is 68 miles north of the capital, and Brownsville is 51 miles east of the capital. How far is it from Circleville to Brownsville?

382. How much does a man gain by crossing diagonally a field 532 yards long and 165 yards wide, instead of going along side and end?

383. A tree 100 feet high throws a shadow 75 feet long. How far is it from the end of the shadow to the top of the tree?

384. If a street 5 miles long contains $30\frac{10}{33}$ acres, what is its width?

385. How many bricks 9 inches long and $4\frac{1}{2}$ inches wide will be required to pave a space 18 feet long by $12\frac{3}{4}$ feet wide?

386. The area of a trapezoid is $2\frac{1}{2}$ acres, and the sum of the parallel sides 10 chains. What is the altitude?

387. A prism is 8 feet in length, in breadth, and in height. What is its whole surface?

388. What is the whole surface of a cube whose side is 3 feet?

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389. How many cubic yards of earth must be taken out in digging a well 5 feet in diameter and 40 feet deep?

390. The perimeter of an isosceles triangle is 153 yards, and each of the equal sides is $\frac{5}{8}$ of the third side. What is the area?

391. Find the side of a cube that contains 32,768,000 cubic rods.

392. What length must be cut from the narrow end of a board to contain 1 square foot; the length of the board being 6 feet, and its width 12 inches at the one end, and 8 inches at the other?

393. The base of a right triangle is 60, perpendicular 45. Find the hypotenuse.

394. The hypotenuse is 41 feet, the base 40 feet. Find the perpendicular.

395. A ladder 53 feet long reaches a window 45 feet from the ground. How far is the foot of the ladder from the bottom of the wall?

396. A well is 63 feet deep and 16 feet wide. What is the length of the longest pole that can be placed entirely within the well?

397. A mast 77 feet high stands in the middle of a ship 72 feet wide. How long is the rope ladder from the ship's side to the mast-head?

398. A tree 72 feet high is broken 20 feet from the ground. How far from the foot will the top reach?

399. A rope 73 feet long reaches from the edge of a ring to the top of a centre pole 55 feet high. How wide is the ring?

400. A boy is due south from his home 144 miles; he travels due west 165 miles. How far is he then from home?

401. A field is 12 rods square. What is the side of another field containing 1 square rod more than twice as much as the first?

402. One side of a right-angled triangle is 3,925 feet; the difference between the hypotenuse and the other side is 625 feet. Find the hypotenuse and the other side.

403. The top of a liberty-pole, being broken off by a blast of wind, struck the ground at a distance of 15 feet from the foot of the pole. Find the height of the whole liberty-pole, supposing the length of the broken piece to be 39 feet.

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404. The solid contents of a cubic block of wood is 64 cubic feet. Find the length of the diagonal of the cube.

405. A stick of timber 3 feet square and 16 feet long is sawn into inch lumber. How many feet will it make, $\frac{1}{8}$ being lost in sawing?

406. A stick of square timber 48 feet long contains 300 cubic feet. Find its width and depth.

407. A farmer owns a field whose opposite parallel sides, 100 rods and 60 rods respectively, are 40 rods apart. Find the value of his land at $35 an acre.

408. A school site of $1\frac{1}{4}$ acres, whose length is twice its breadth, has a school-house of the same shape as the lot, which covers $\frac{16}{1089}$ of its area. Find the length in feet of the school-house.

409. A township 10 miles square inside its boundary road has roads 4 rods wide, laid out $1\frac{1}{4}$ miles apart, and all running at right angles to the boundary lines. Find the number of acres taken up with roads.

410. Which will carry the largest amount of water, two 3-inch or one 4-inch tile? Consider speed the same in both cases.

411. A ditch 10 feet wide at the top and 6 feet wide at the bottom is to be dug 4 feet deep. Find the quantity of earth thrown out per rod of length.

412. The sides of a triangular farm ABC are: AB, 60 rods; BC, 100 rods; and CA, 80 rods. A straight road is cut from A to its boundary BC, meeting it at right angles; also another from A to meet BC at its middle point. Neglecting the width of roads, find the area of the field lying between the roads.

413. Each side of a cistern whose base is an equilateral triangle is 4 feet. It is $6\sqrt{3}$ feet deep. What part of the cistern is filled by a ton of water?

414. A farmer owns a field in the form of an isosceles triangle, the equal sides being each 100 rods, and the other side 160 rods. Find the area of the field.

415. Find the difference in area of a square and an equilateral triangle each of whose sides is 6 feet.

416. A field in the form of an equilateral triangle contains $20\sqrt{3}$ acres. Find the length of a side.

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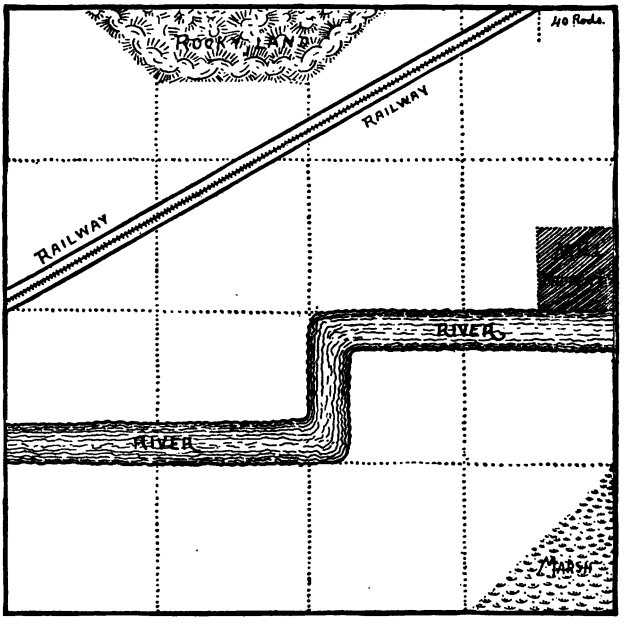
417. Find the third side of an isosceles triangle containing $46\frac{7}{8}$ acres, each of whose equal sides is $\frac{5}{8}$ of the third side.

418. A field in the form of a rectangle, one side of which is $2\frac{1}{2}$ times the other, contains 25 acres. Find the shorter side.

419. Into a cubical box 6 feet each way is put another cubical box 5 feet each way. Find the amount of unoccupied space, neglecting thickness of boxes.

420. How much less will it cost to enclose 160 acres in the form of a square than in the form of a rectangle whose length is 4 times its breadth, with fencing which costs \$1.25 per rod?



421. A farmer buys a section of land of which the accompanying illustration is a diagram. The railway occupies a strip 8 rods wide; the river is 20 rods wide, and the rocky land, marsh, and mill property are as represented; the railway track is 320 rods long, and the distance from the west crossing to the northwest corner of the section is 160 rods. Find

(*a*) The number of acres of farming land in the section.
(*b*) The number of acres cut off by the railway.
(*c*) The number of acres south of the river.
(*d*) The number of acres occupied by the railway.
(*e*) The area of the river surface in acres.

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422. Two circles, the radius of each being 7 feet, are placed on the surface of a circle whose radius is 14 feet. Find the number of square feet not covered.

423. A pole put to the bottom of a lake is found to reach 5 feet above the surface. The top moved along the surface through a distance of 35 feet is then just under the water. Find the depth of the water.

424. Two posts stand one on each side of a street which is 70 feet wide. Their tops, which are $50\sqrt{2}$ feet apart, are just reached by a ladder 50 feet long, whose bottom end is fastened at a point in the street. Find the height of the posts.

425. Find the surface of a cube each of whose edges is 8 feet in length.

426. Find the quantity of inch lumber that it will take to side up a barn 40 feet by 60 feet, the gables, on account of waste, taking two-thirds of what the ends do. Assume in the calculation that lumber 16 feet long is the right length.

427. How many pickets 3 inches wide will it take to put up a fence 40 rods long, a space of 3 inches being allowed between pickets?

428. Which will carry the larger amount of water, two 4-inch or one 6-inch tile? Consider speed the same in both cases.

429. How many bushels of wheat in a bin 8 feet long, 6 feet wide, and filled to the height of 4 feet, given that a bushel contains 2.150 cubic inches?

430. Find the value of the 2-inch plank at $20 per thousand that will be needed to make a land-roller whose circumference is 15 feet and length 12 feet.

431. A farm in the form of a square containing 160 acres is divided into square 10-acre fields. Find the number of rails at 14 to a rod necessary to fence it.

432. A board fence with posts 7 feet apart is built with five boards, one 10-inch, one 8-inch, and three 6-inch boards. Find the value of sufficient 14-foot lumber to build 40 rods at $11 a thousand.

433. A farmer owning a farm one mile square builds a barn on it 60 feet by 100 feet. What part of the farm is covered by the barn?

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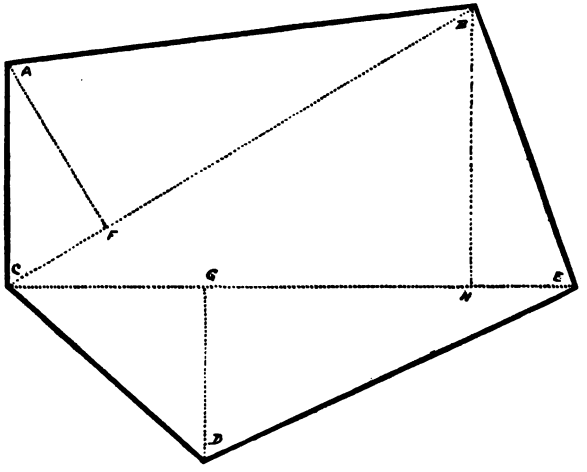
434. A circular fish-pond, 4 rods in diameter, is filled with water to a uniform depth of 7 feet. One-half the water is frozen. Find the number of cubic feet of ice formed, the bulk increasing $\frac{1}{10}$ in freezing.

435. Find the value of the land taken up by a railway track 4 rods wide and 10 miles long, at \$40 per acre.

436. The sides of a four-sided field $ABCD$ are: $AB = 70$ rods, $BC = 65$ rods, $CD = 95$ rods, and $DA = 60$ rods. Find the area of the field in acres.

437. The accompanying diagram represents a piece of land of irregular shape. The diagonal and altitude measurements are:



$AF = 60$ rods, $BC = 210$ rods, $BH = 100$ rods, $CE = 230$ rods, $GD = 75$ rods. How many acres are there?

438. A rectangular field 70 rods long contains 28 acres. Find its width.

439. A cellar 18 feet by 24 feet is paved with brick 9 inches square. Find number.

440. Find quantity of 16-foot lumber necessary to build a tight board fence 8 feet high and 40 rods long.

441. A brick wall 60 feet long, whose thickness is one and a half bricks, is carried to a height of 45 feet. Find number of bricks necessary to build it, a brick being 9 inches by $4\frac{1}{2}$ inches, and $2\frac{1}{4}$ inches thick.

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442. Find cost of paving a hexagonal court, each side being 60 feet, at a cost of \$3 per square yard.

443. A land-roller $3\frac{1}{2}$ feet in diameter has its surface painted at a cost of 27 cents per square yard, its length being 14 feet. Find cost.

444. Which is nearer an acre, a square 208 feet each way or a square 209 feet side?

445. Find the length of the side of a square acre correctly to an inch.

446. On a barn 40 feet by 60 feet the roof rises 9 inches in every foot of width of the barn. Find number of square feet of surface of roof, allowing a width of 3 feet for the two ends.

447. A pole whose circumference is 9 inches and height is 30 feet has around it a wire in the form of a spiral which goes round it once every foot. Find length of wire.

448. Find the amount of surface to a stick of square timber of uniform size, each side being 4 feet and length 40 feet.

449. Find the amount of surface to a uniformly tapering stick of timber, the butt end being 4 feet square and the top end 2 feet square and length 60 feet.

450. The diagonal of a cube is $12\sqrt{3}$ feet. Find its surface and solid contents.

451. The bottom of a ladder is placed at a point 14 feet from a house, and the top of the ladder rests against the house at 48 feet from the ground; and on turning the ladder over to the other side of the street its top rests at 40 feet from the ground: find the breadth of the street.

452. A footpath goes along two adjacent sides of a rectangle; one side is 196 yards, and the other is 147 yards: find the saving in distance made by proceeding along the diagonal instead of along the two sides.

453. The shadow of man 6 feet high standing upright was measured and found to be 8 feet 6 inches; the shadow of flag-staff, measured at the same time, was found to be 56 feet 8 inches: determine the height of the flag-staff.

454. A country is 500 miles long: find the length of a map which represents the country on the scale one-eighth of an inch to a mile.

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455. The distance between two towns is 31 miles, and the distance between their places on the map is $7\frac{3}{4}$ inches: find the scale on which the map is drawn.

456. The distance between two towns is 54 miles, and the distance between their places on the map is $6\frac{3}{4}$ inches: find the distance between two other towns if the distance between their places on the map is $8\frac{1}{2}$ inches.

457. Assuming that the circumference of a circle is $3\frac{1}{7}$ times the diameter, find the diameter of a circle whose circumference is 66 yards.

458. The diameter of a carriage wheel is 28 inches: find how many turns the wheel makes in travelling a mile.

459. A road runs round a circular shrubbery; the outer circumference is 600 feet, and the inner circumference is 480 feet: find the breadth of the road.

460. The difference between the diameter and the circumference of a circle is 10 feet: find the diameter.

461. The area of a chess-board having 8 squares along each side is 100 square inches: find the length of the side of one of the squares.

462. A plank is 18 inches broad: find what length must be cut off that the area may be a square yard.

463. A street is a quarter of a mile long: find the number of square yards in a pavement $4\frac{1}{2}$ feet wide down one side of the street.

464. A rectangular garden is to be cut from a rectangular field, so as to contain three-quarters of an acre; one side of the field is taken for one side of the plot, and measures $2\frac{1}{2}$ chains: find the length of the other side.

465. The sides of four squares being respectively 1, 2, 4, and 10 feet, find the side of the square which is equal to the sum of the four.

466. A lawn measures 150 feet by 120 feet: find how many pieces of turf are required to cover it, each piece being 3 feet 4 inches by 1 foot 3 inches.

467. Find how many persons can stand in a room measuring 15 feet by 9 feet; supposing each person to require a space of 27 inches by 18 inches.

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468. A procession is formed of 504 ranks of men, 14 in a rank: if the men were arranged in a solid square, find how many there would be in a side.

469. Find how many trees there are in a wood half a mile long and a quarter of a mile wide, supposing on an average four trees grow on each square chain.

470. The side of a square is 85 yards, and a path 10 yards wide goes round the square outside of it: find how many stones 1 foot 4 inches by 10 inches will be required to pave the path.

471. If the adjacent sides of one rectangle are 9 and 16, and of another 36 and 25, compare the sides of the squares respectively equal to these rectangles.

472. A rectangle measures 48 feet by 28 feet: find the area of a square which has the same perimeter as the rectangle.

473. A rectangle contains 1,323 square feet; and it is three times as long as it is broad: find its longest side.

474. Show by examples that if a square and a rectangle have equal perimeters, the area of the square exceeds the area of the rectangle by the area of a square the side of which is half the difference of the sides of the rectangle.

475. The adjacent sides of a parallelogram are 8 feet and 16 feet, and its area is half that of a square having the same perimeter: find the perpendicular distance between each pair of opposite sides.

476. Find the area of the right-angled triangle having the following dimensions: hypotenuse 421, side 29.

477. The area of a rhombus is 52,204 square feet, and one diagonal is 248 feet: find the other.

478. The area of a trapezoid is $3\frac{1}{8}$ acres; the sum of the two parallel sides is 242 yards: find the perpendicular distance between them.

479. A field containing 3,600 square yards is laid down on a plane to a scale of 1 inch to 10 feet.

480. Determine the scale used in the construction of a plane upon which every square inch of surface represents a square yard.

481. A field is ten thousand times as large as the plane which has been made of it: find what length on the plane will represent a length of 20 yards in the field.

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482. The sides of a triangle are in the proportion of 2 to 3; and the area is 210 square feet: find the sides.

483. Show that a cube 6 inches long is equivalent to the sum of three cubes which are respectively 3 inches, 4 inches, and 5 inches long.

484. The beams of wood used in building a house are 3 inches thick and 10 inches wide; 200 of them are used, which together amount to 1,000 cubic feet: find the length of each beam.

485. A certain book is 8 inches long, $5\frac{1}{4}$ inches broad, and $2\frac{1}{4}$ inches thick: find how many such books can be packed in a box which is 3 feet 6 inches long, 3 feet broad, and 2 feet deep.

486. A reservoir is 24 feet 8 inches long by 12 feet 9 inches wide: find how many cubic feet of water must be drawn off to make the surface sink 1 foot.

487. A vessel is the shape of a cube; it is without a lid. If the external length is 3 feet, and the thickness of the material 1 inch, find the number of cubic inches of the material.

488. Find the number of cubic feet of earth which must be dug out to form a ditch 1,000 feet long, 8 feet deep, 16 feet broad at the bottom, and 20 feet broad at the top.

489. The area of two squares is 100 acres, and the side of one is three times as long as the side of the other: find the area of each.

490. The perimeter of a rectangle is 144 yards, and the length is three times the breadth: find the area.

491. Two roads cross at right angles; two men start at the same time from the point where the roads meet, one man walking along one road at the rate of 4 miles an hour, and the other man walking along the other road at the rate of 3 miles an hour: find how far apart the men are 10 minutes after starting.

492. The perimeter of one square is 748 inches, and that of another is 336 inches: find the perimeter of a square which is equal in area to the two.

493. A square contains 3,690 feet 81 inches: find its side.

494. Find how long it will take to walk round a field containing 13 acres 1,089 yards, in the form of a square, at the rate of $2\frac{1}{2}$ miles an hour.

495. The sides of a triangle are 848, 900, and 988 links: find the area.

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496. Determine the excess of 15 feet square over 15 square feet.

497. There are two rectangular fields equal in area; the sides of one field are 945 yards and 1,344 yards in length, and the longer side of the other field is 1,134 yards: find the length of the shorter side.

498. Find the side of a square which contains 7,267 square feet 52 inches.

499. The area of a rectangular field whose length is three times its breadth is 6 acres 960 yards: find its perimeter.

500. The perimeter of an isosceles triangle is 306 feet, and each of the equal sides is $\frac{5}{8}$ of the third side: find the area.

501. A square yard is divided into 576 equal squares: find the length of a side of each.

502. Find the side of a square whose area is equal to a rectangle 81 feet long and $60\frac{3}{4}$ inches wide.

503. A rectangular field is 300 yards long and 200 broad: find the distance from corner to corner. If a belt of trees 30 yards wide be planted round the field, find the area of the interior space.

504. The sides of a triangle are 25, 39, and 56 feet respectively: find the areas of the two triangles into which it is divided by the perpendicular from the angle opposite the largest side on that side.

505. A room is 15 feet 9 inches long: find its breadth that it may contain 21 square yards.

506. Find the length of a side of a square which is equal in area to a rectangle 972 yards long and 363 yards broad.

507. $ABCD$ is a four-sided figure; BC is parallel to AD; $AB = BC = CD = 325$ feet; and $AD = 733$ feet: find the area.

508. Find how many planks, each $13\frac{1}{2}$ feet long and $10\frac{1}{2}$ inches wide, will be required for the construction of a platform 54 yards long and 21 yards broad.

509. A person has a triangular-shaped garden, the base of which contains 200 yards, and divides it into two equal parts by a hedge parallel to the base: find the length of the hedge.

510. Find the thickness of a solid whose length is 2 yards, breadth $1\frac{1}{2}$ yards, and solid contents 1 cubic yard 6 cubic feet and 1,296 cubic inches.

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511. A room 18 feet 9 inches long and 13 feet 4 inches broad is flooded with water to a depth of 2 inches. Find the weight of the water, supposing a cubic foot of water to weigh $62\frac{1}{2}$ pounds.

512. A box is 4 feet long, $2\frac{1}{2}$ feet wide, and $1\frac{1}{2}$ feet deep; in it are packed 252 books each 8 inches long, 5 inches wide, and $1\frac{1}{2}$ inches thick. Find how many more books each 6 inches long, 3 inches wide, and $1\frac{1}{4}$ inches thick can be packed in the box.

513. The surface of a certain solid is three times as great as the surface of a similar solid. Find the proportion which the volume of the first solid bears to the volume of the second.

514. A river 30 feet deep and 200 yards wide is flowing at the rate of 4 miles an hour. Find how many tons of water run into the sea per minute.

515. Find how many cubical packages, each having $4\frac{1}{3}$ inches in an edge, will fill a box whose length, breadth, and depth are 2 feet 2 inches, 3 feet 3 inches, and 4 feet 4 inches.

516. Find how many cubes whose edges are $2\frac{3}{4}$ inches can be cut out of a cube whose edge is 22 inches.

517. The breadth of a room is two-thirds of its length and three-halves of its height; the volume of the room is 5,832 cubic feet. Find the dimensions.

518. The base of an isosceles triangle measures 50 feet, and each side 65 feet. Find the perpendicular.

519. A rope $76\frac{1}{2}$ feet long will just reach from one side of a street to the top of a house $67\frac{1}{2}$ feet high on the opposite side. How wide is the street?

520. Find the cubical contents of a room which is 24 feet 9 inches long, 18 feet 4 inches wide, and 10 feet 8 inches high.

521. A piece of gold leaf is $\frac{1}{1008}$ of an inch in thickness. How much solid gold is there in enough of this to cover 63 square feet?

522. The diagonal of a cubical block of wood is 2 feet 6 inches. Find its volume.

523. Find the hypothenuse of a right-angled triangle whose base is 168 yards and perpendicular 425 yards.

524. Find the area of a triangle whose sides measure 277, 315, and 304 yards.

525. A mirror 5 feet square is to be cut into the largest possible circular mirror. What is the area which will be wasted?

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526. Three squares contain respectively 36, 64, and 576 square feet. Find the length of a side of that square which has an area equal to four times their sum.

527. A triangular field contains exactly one acre of land, and its perpendicular measures 40 yards. Find the length of its base.

528. The diagonal *AC* of a four-sided field is 967 links, and its sides are: *AB*, 751 links; *BC*, 821 links; *CD*, 205 links; *DA*, 715 links. Find its area.

529. A trapezoid contains 132 square yards, and its parallel sides are 45 feet and 50 feet. Find the perpendicular distance between them.

530. A vertical pole 5 feet high casts a shadow of 7 feet. Find the length of a shadow cast by a chimney 46 yards high.

531. Two squares have sides of 187 feet and 84 feet. Find the perimeter of the square which is equal in area to four of each of such squares added together.

532. It requires 14 turns of the handle to raise a bucket from the bottom of a well, and the axle on which the chain is coiled is $10\frac{1}{2}$ inches in diameter. How deep is the well?

533. A ladder 42 feet long stands on the ground 11 feet from the wall of a house against which it leans; if the foot of the ladder be drawn 2 feet outwards, how far will the top of the ladder descend?

534. The fore wheel of a bicycle is 21 inches in diameter. How many times does it turn round in a distance of $1\frac{1}{2}$ miles?

535. How many times greater must be the diameter of a circular lawn which contains exactly 2 acres, than that of another which contains one-half an acre?

536. A ladder 65 feet long reaches a window 56 feet high from the ground. Find the distance of the foot of the ladder from the side of the house.

537. Two columns whose heights are respectively 17 feet and 50 feet stand on the same horizontal plane with their bases 56 feet apart. Find the distance between the tops of these columns.

538. Find the length of a beam which shall rest on two walls standing on the same horizontal plane, and which are respectively 4 feet and 8 feet 4 inches high, when the distance between them is 13 feet 9 inches.

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539. Two persons, travelling at the rate of 6 and 8 miles per hour respectively, proceed in directions at right angles to each other. Find the distance between them at the end of 6 hours.

540. A scaffolding pole 40 feet long, placed at a distance of 21 feet from the side of a house, is partially broken by the wind, at the height of 5 feet from the ground, so that its top strikes against the wall. Find at what height from the ground it will strike the wall.

541. A ladder 55 feet long may be so placed in a street as to reach a window 44 feet high on one side, and on being turned round without changing its position, it will reach another window 33 feet high on the opposite side of the street. Find the breadth of the street.

542. The breadth of the gable-end of a house is 56 feet, the perpendicular height of the roof is 15 feet, and the distance of the ridge from one of the eaves is 25 feet. Find the distance of the ridge from the other eave.

543. A mast being partially broken by the wind at the height of 20 feet from the deck, its top touches the deck at an angle of 30°. Find the entire length of the mast.

544. How many square feet are there in a gravel walk 2 feet wide, running all round the outside of a rectangular garden which is 40 feet long and 28 feet broad?

545. A certain street $\frac{1}{2}$ of a mile long covers $1\frac{1}{4}$ acres. What is the breadth of the street?

546. The hypothenuse of a right-angled triangle is 76 yards, and its other sides are equal. Find the area.

547. How many square feet of wood will be required for a rectangular floor whose sides measure respectively 26 feet, 35 feet, and 51 feet?

548. The minute-hand of a clock is 7 inches long. Find the length of the circle that its point will describe in an hour.

549. A square piece of paper is 5 feet 10 inches long. Out of it is cut the greatest possible circle. Find how many square inches of paper are cut away.

550. Find the side of a square whose area is equal to that of a rectangle 81 feet long and $60\frac{3}{4}$ inches wide.

551. Find the area of a triangle whose sides are respectively 130, 140, and 150 yards long.

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552. The top of a ladder touches a wall 4 yards above the ground, when its foot is placed 3 feet 6 inches from the wall; how long is the ladder?

553. The area of a rectangular field is 975,744 square feet, and one side is $3\frac{1}{2}$ times the other. Find the shorter side.

554. The sides of a triangle are 11, 24, and 31. Show that its area is $66\sqrt{3}$.

555. How long will it take a man to walk around a square field whose area is $5\frac{5}{8}$ acres, at the rate of a mile in $10\frac{2}{3}$ minutes?

556. If 15 trees can be planted on 2 square chains of ground, how many can be planted on a rectangular area 1,210 yards long and 2,244 yards wide?

557. The perimeter of a rectangular field whose length is three times its breadth is 800 yards. Find its area.

558. A rectangular grass plot 120 feet long and 80 feet wide is surrounded by a gravel walk 6 feet wide. Find the area of the walk in square yards.

559. The sides of a rectangle are 16 and 24 feet. What breadth of border must be taken off all round that the remaining area may be 240 square feet?

560. The difference between the areas of two squares inscribed and circumscribed about a circle is 338 square feet. Find the radius of the circle.

561. The length of a rectangular field is to its breadth as 6 to 5. The area is 750 square yards. Find the length.

562. One side of a triangle is half the sum of the two others. The sum of the sides is 84 feet, and the area is 14 square yards. Find the sides.

563. A railway 600 chains long is ballasted with gravel to the depth of $1\frac{1}{2}$ feet. Find the width of the roadway, if 9,240 truck loads are required, each truck holding $2\frac{1}{2}$ cubic yards of gravel.

564. Find the altitude of a triangle whose base is 75, and the other sides 65 and 20 yards long respectively.

565. The sum of the sides of an isosceles triangle is 306 feet, and each of the equal sides is $\frac{5}{8}$ of the third side. Find its area.

566. The area of an equilateral triangle described on a side of a rectangle is equal to the area of the rectangle. Find the ratio of the sides of the rectangle.

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567. The sides of a right-angled triangle are in arithmetical progression, and its area is 150 feet. Find the hypothenuse.

568. The four sides of a field are 75, 100, 125, and 200 chains respectively. The first two sides form a right angle. Find the area in acres.

569. The radius of a circle is $\sqrt{2}$ inches. Two parallel straight lines are drawn in it, each an inch from the centre. Find the area of the part of the circle between the straight lines.

570. How many shrubs placed 3 yards apart can be planted round the perimeter of a semicircular lawn, the radius of which is 144 feet?

571. Find the side of a square field whose area is equal to that of a rectangle 1,800 yards by 800 yards.

572. The diagonal of a square field is 1,210 yards. How many acres does the square contain?

573. The base of the Great Pyramid of Egypt is a square of 764 feet on each side. Find the number of acres of ground covered by it.

574. The diagonals of a field, the sides of which are all equal, are 20 and 30 chains. Find its area.

575. Ascertain the height of a room, measuring 10 feet 6 inches long and 15 feet wide, and containing 2,475 cubic feet of air.

576. A factory chimney 250 feet high is built on the bank of a river 40 feet wide. What length of rope will reach from the top of the chimney to the opposite bank of the river?

577. How many yards of canvas will cover the gable end of a tent 30 feet wide, the perpendicular height of the gable being 36 feet?

578. Two trains start from the same station; one travels 100 miles due west, and the other 160 miles due north. How far apart are they when each journey is complete?

579. What is the area of an isosceles triangle whose base is 20 inches, and whose equal sides are each 15 inches?

580. A cord $39\frac{1}{4}$ yards long was fastened by one end to a stake in the centre of a field, and the other end to the horns of a cow. What area of grass was allowed for the cow?

581. What is the area of a carriage drive 12 feet wide from the fence of a circular park the diameter of which is 320 rods?

582. Having a lawn an acre in extent, I wish to make a circular fish-pond in the centre, which shall take up only half the lawn. Required the diameter.

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583. A room containing 27,000 cubic feet of air is 30 feet wide and half as high. Required its length.

584. A carpenter has 2 boards an inch thick, each 9 feet long 15 inches wide; out of them he makes a box 2 feet 6 inches long, 1 foot 4 inches deep, and 18 inches wide. How much material is wasted?

585. A carriage wheel is $4\frac{1}{2}$ feet in diameter. How many times will it turn in a distance of 54 miles?

586. A room is 60 feet long, 18 feet 5 inches broad, and 17 feet 6 inches high. How many boxes will it hold, each box being 3 feet 2 inches by 1 foot 5 inches by 1 foot 4 inches?

587. How many planks, each $13\frac{1}{2}$ feet long and $10\frac{1}{2}$ inches wide, will be required for the construction of a platform 54 yards long and 21 yards broad?

588. How many tiles, each 7 inches square, will be required to cover a floor 19 feet 3 inches by 13 feet 5 inches?

589. A cubic foot of wood weighs 20 pounds. Find the weight of 10 planks, each 30 feet long, 1 foot wide, and 1 inch thick.

590. Supposing the area of a circle to be $3\frac{1}{7}$ times the square of the radius, find the weight of a circular disc of cast iron 7 feet in diameter and $1\frac{1}{8}$ inches thick, it being given that a plate 1 foot square and 1 inch thick weighs $37\frac{1}{2}$ pounds.

591. A room 11 feet high is half as long again as it is wide, and its cubical contents is $4{,}768\frac{1}{2}$ feet. Find its length and breadth.

592. How do you find the area of a trapezoid?

593. Quote the rule for finding the area of a triangle when the three sides only are given.

594. Quote the rule for finding the area of a circle.

595. When the solidity of a cube is given, how do you find its side?

596. How do you find the diameter and the circumference of a circle, the one from the other?

597. How do you find the area of a circle?

598. Explain the method of measuring 12-foot lumber.

599. Tell what you know about the measures used in the Metric System.

600. Quote rules for the guidance of stone-masons, carpenters, brick-layers, lathers, plasterers, and painters, respectively.

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ANSWERS.

1. 495 in.
2. 792 in.
3. 2,376 ft.
4. 19,200 rods.
5. 58 in.
6. 8,000 links.
7. 28 ft.
8. $389.50.
9. 24 ft.
10. $3,696.
11. $44.
12. $3,240.
13. 1,320 steps.
14. 5,280 rev's.
15. $17.50.
16. $11.
17. 2,200 poles.
18. 1. 18,876 ft.;
    2. $60\frac{1}{2}$ ft.;
    3. 48,411 ft.
19. 7,920 pick's.
20. 880 posts.
21. 1,296 sq. in.
22. 4,356 sq. ft.
23. 48,400 sq. yds.
24. $163.35.
25. $250.85.
26. $2,080.
27. $250.
28. 121 plots.
29. 12 pieces.
30. 108 sq. ft.
31. 3,024 sq. in.
32. $13\frac{1}{2}$ sq. yds.
33. 15 acres.
34. $25.50.
35. $270.
36. 9 yds.
37. 64 rods.
38. $491.50.
39. 9,600 sq. ft.
40. 3,520 bricks.
41. 2,916 shovelful.
42. 233,280 cu. in.
43. 110,592 cu. in.
44. 225 cu. ft.
45. 24 cu. yds.
46. 1,680 cu. ft.
47. $20.
48. 160 in.
49. 2,475 lbs.
50. 35,640 st.
51. 19,250 lbs.
52. 3,520 loads.
53. 5 loads.
54. 128 cu. ft.
55. 442,368 cu. in.
56. 9 cords.
57. 150 cords.
58. $15\frac{5}{8}$ cords.
59. $540.
60. $2,470.50.
61. 4 ft.
62. 10 ft. 8 in.
63. $3\frac{5}{8}$ ft.
64. 30 cords.
65. $4\frac{4}{7}$ ft.
66. 640 ft.
67. 30 beds.
68. 192 fields.
69. 23,040 acres.
70. 320 acres.
71. 80 acres.
72. 160 rods sq.
73. $5,760.
74. 192 half-sec's.
75. $1,728,000.
76. $13\frac{1}{2}$ acres.
77. $3\frac{1}{8}$ acres.
78. 15 acres.
79. $34\frac{1}{11}$ acres.
80. 360 acres.
81. $7\frac{1}{2}$ acres.
82. 15 acres.
83. 2.1125 acres.
84. $27.50.
85. $65.
86. $640.
87. $1,170.
88. $40.
89. $61.60.
90. 12 sq. ft.
91. 6 ft.
92. 1. 12 ft.;
    2. 12 ft.;
    3. 10 ft.
93. $37\frac{1}{8}$ ft.
94. $50\frac{3}{8}$ ft.
95. 1. 20 ft.
    2. $24\frac{1}{2}$ ft.
96. 320 ft.
97. 108 ft.
98. 5,760 ft.
99. 240 ft.
100. 2,060 ft.
101. 320 ft.
102. $22.93.
103. $28.60.
104. $10.
105. $39.60.
106. $67.
107. $17.60.
108. $544.32.
109. $96.76.
110. $35.83.
111. 120 ft.
112. $1,066\frac{2}{3}$ ft.
113. 1,400 ft.
114. 1,694 ft.
115. 960 cu. ft.
116. 32 cu. ft.
117. 9 cords.
118. 750 cu. ft.

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119. 72 cords.
120. 13½ cords.
121. $30.24.
122. 14½ cords.
123. 14 cords.
124. $128.
125. 36 bush.;
12 yds.
126. $86.88.
127. 100 per.
128. $31.51.
129. $150.
130. 88 per.
131. 88 per.
132. 46 per.
133. $249.75.
134. 20⅘ bricks.
135. $446.25.
136. 2,304 bricks.
137. 2,400 bricks.
138. 10,286 bricks.
139. 16,458 bricks.
140. 13,166 bricks.
141. 37,440 bricks.
142. $156.81.
143. $175.39.
144. $262.83.
145. 22,793 bricks.
146. 20,708 bricks.
147. 13,742 bricks.
148. 5 bricks.
149. 6 bricks.
150. 288 bricks.
151. 1,040 ft.
152. 192 strips.
153. $23.76.
154. 25 boards.
155. 96 ft.
156. 1,632 ft.
157. 1,920 ft.
158. 2,520 ft.
159. $13.82.
160. 1,920 ft.
161. 1,666 ft.
162. 1,280 ft.
163. $13.44.
164. $4.77.
165. 280 ft.
166. $3.51.
167. 4,250 sh.
168. 50 bun.
169. 4½ th.
170. 16 sq. in.
171. 9 sh.
172. 11,250 sh.
173. 48 bun.
174. 39 bun.
175. $86.40.
176. 55 bun.
177. $51.56.
178. 19,440 sh.
179. $5.75.
180. 90 sq. in.
181. 15 laths.
182. 31¼ sq. ft.
183. 20 bun.
184. 36 bun.
185. 25 bun.
186. 395 bun.
187. $15.30.
188. $6.75.
189. 5 bun.
190. 160 sq. yds.
191. 134 sq. yds.
192. 235 sq. yds.
193. 262 sq. yds.
194. $4.32.
195. $24.30.
196. $32.75.
197. 1. $10;
2. $8.75;
3. $25.
198. $10.44.
199. $18.15.
200. $22.66.
201. $14.30.
202. $36.48.
203. 96 sq. yds.
204. $24.88.
205. $32.64.
206. $48.
207. $43.52.
208. $57.60.
209. $8.75.
210. $147.
211. $33.
212. 94$\frac{3}{17}$ lbs.
213. 15½ lbs.
214. 56 strips.
215. 60 strips.
216. 33 strips.
217. 24 strips.
218. 4 strips.
219. 12 rolls.
220. 4 rolls.
221. 12 rolls.
222. 7 rolls.
223. $2.52.
224. $10.
225. $9.75.
226. $20.25.
227. $8.10.
228. $1.96.
229. $3.90.
230. $7.46.
231. $6.56.
232. $10.80.
233. $20.
234. 16 ft. 6 in.
235. 9 breadths.
236. 6 breadths.
237. 49½ yds.
238. 52½ yds.
239. 15 ft.
240. 8 breadths.
241. 41⅔ yds.
243. 52½ yds.
244. 51 yds.
245. $130.
246. $18.
247. $54.50.
248. $8.50.
249. $10.40.
250. $6.30.
251. 56 yds.
252. 189 posts.
253. 440 posts.
254. $47.
255. 470 scantlings.
256. 235 boards.
257. 11,280 ft.
258. $219.96.
259. 2,310 ft.
260. 330 scantlings.
261. 1,980 pickets.
262. 4,000 pickets.
263. 672 pickets.
264. 1,650 ft.
265. $1,267.20.
266. $103.95.
267. $256.
268. $451.45.
269. 125 cu. ft.

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270. 192 bush.
271. 750 cu. ft.
272. $6\frac{1}{4}$ ft.
273. 48 bush.
274. 640 bush.
275. 1 ft.
276. $36\frac{2}{3}$ bush.
277. 112 bush.
278. 560 bush.
279. 5,000 cu. ft.
280. $12\frac{1}{2}$ ft.
281. 20 bush.
282. 20 in.
283. 320 bush.
284. 105 bbls.
285. $6\frac{9}{16}$ ft.
286. $23\frac{23}{24}$ in.
287. 100 cu. ft.
288. 15 ft.
289. 5 sq. ft.
290. 6 yds.
291. 384 bush.
292. $987\frac{3}{7}$ gal.
293. 240 cu. ft.
294. 320 bbls.
295. 78 posts.
296. 1,386 pickets.
297. \$100.
298. $68\frac{1}{3}$ ft.
299. 700 ft.
300. \$0.522.
301. 4 miles.
302. 1,210 ft.
303. \$200.
304. 7,841 sods.
305. \$605.
306. $607\frac{1}{2}$ lots.
307. 71 yds.
308. 198 sq. yds.
309. $\$278\frac{1}{4}$.
310. \$117.45.
311. \$30.80.
312. 540 sq. ft.
313. \$45.
314. 240 planks.
315. 384 men.
316. 12,800 trees.
317. 45,000 cu. ft.
318. $93\frac{3}{4}$ cords.
319. 1,800 acres.
320. 60 acres.
321. 178 perches.
322. \$304.128.
323. \$13,305.60.
324. 99 furrows.
325. 540 sections.
326. 31,360 acres.
327. 165 ft.
328. 132 trees.
329. $7\frac{1}{5}$ ft.
330. $7\frac{1}{2}$ acres.
331. \$1,296.
332. \$34.65.
333. 288 bush.
334. 38,720 sq. yds.
335. 2,304 ft.
336. $23\frac{4}{7}$ miles.
337. 880 rods.
338. 240 acres.
339. $\frac{1}{5}$
340. 25,350 sq. in.
341. \$6.48.
342. \$21.78.
343. 64 rods.
344. $216\frac{8}{9}$ sq. ft.
345. 640 ft.
346. 579.6 acres.
347. 528 cu. ft.
348. 40 rods.
349. 37 cu. ft.
350. \$384.
351. 17,920 acres.
352. 1,440 rails.
353. $\frac{1}{9\,3\,8\,1\,2}$ in.
354. 78 ft.
355. \$173.
356. 21 yds. 2 ft. $2\frac{5}{6}$ in.
357. \$24.
358. \$58.50.
359. 406 trees.
360. 288 trees.
361. 1,240 in.
362. 13,824 pints.
363. 512 blocks.
364. $7\frac{1}{5}$ ft.
365. 65 men.
366. 1,200 gals.
367. 198 miles.
368. 144 ft.
369. 150 ft.
370. 50 miles; S.
371. 32 ft.
372. $21\frac{1}{3}$ hours.
373. \$259.50.
374. 220 yds.
375. $8\frac{3}{4}$ acres.
376. \$540.
377. 27 ft.
378. 25 yds.; 75 yds.
379. 20 rods.
380. 45.
381. 85 miles.
382. 557 yds.
383. 125 ft.
384. 50 ft.
385. 816 bricks.
386. 5 chains.
387. 486 sq. ft.
388. 54 sq. ft.
389. $29.08\frac{8}{9}$ cu. yds.
390. 867 sq. yds.
391. 1 mile.
392. 16.996+ in.
393. 75.
394. 9 ft.
395. 28 ft.
396. 65 ft.
397. 85 ft.
398. 48 ft.
399. 96 ft.
400. 219 miles.
401. 17 rods.
402. 12,637 ft.; 12,012 ft.
403. 75 ft.
404. $\sqrt{48}$ ft.
405. 1440 ft.
406. $2\frac{1}{2}$ ft.
407. \$700.
408. 40 ft.
409. $1,273\frac{3}{5}$ acres.
410. Two 3-inch.
411. 528 cu. ft.
412. $2\frac{1}{10}$ acres.
413. $\frac{4}{5}$.
414. 30 acres.
415. $(36-9\sqrt{3})$ sq. ft.
416. 80 rods.
417. $75\sqrt{6}$ rods.
418. 40 rods.
419. 91 cu. ft.
420. \$200.

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421. (*a*) 519 acres.
(*b*) $(80\sqrt{3}-8)$ acres nearly.
(*c*) $212\frac{1}{2}$ acres.
(*d*) 16 acres.
(*e*) 45 acres.
422. 308 sq. ft.
423. 150 ft.
424. 40 ft.; 30 ft.
425. 384 sq. ft.
426. $4{,}053\frac{1}{3}$ ft.
427. 1,321 pickets.
428. One 6-in.
429. $154\frac{67}{415}$ bush.
430. $7.20.
431. 22,400 rods.
432. $21.78.
433. $\frac{5}{23232}$.
434. $13{,}176\frac{9}{10}$ cu. ft.
435. $3,200.
436. $10\frac{1}{1}\frac{5}{8}$ acres.
437. $165\frac{5}{3}\frac{5}{3}$ acres.
438. 64 rods.
439. 768 bricks.
440. 5,280 ft.
441. $3,117.60 nearly.
442. 38,400 bricks.
443. $4.62.
444. Sq. 209 ft.
445. 209 ft. $8\frac{1}{2}$ in.
446. 3,180 sq. ft.
447. $37\frac{1}{2}$ ft.
448. 672 sq. ft.
449. 740 sq. ft.
450. 864 sq. ft.; 1,728 cu. in.
451. $14+30$ ft.
452. 98 yds.
453. 40 ft.
454. 5 ft. $2\frac{1}{2}$ in.
455. $\frac{1}{4}$ mile to 1 in.
456. 68 miles.
457. 21 yds.
458. 360.
459. 19,099 ft.
460. 4.67 ft.
461. $1\frac{1}{1}$ in.
462. 2 yds.
463. 660 sq. yds.
464. 3 chains.
465. 11 ft.
466. 4,320 pieces.
467. 40 persons.
468. 84.
469. 3,200.
470. 30,780 sts.
471. 2 : 5.
472. 1,444 sq. ft.
473. 63 ft.
475. 9 ft.; $4\frac{1}{2}$ ft.
476. 6,090.
477. 421 ft.
478. 125 yds.
479. 324.
480. 1 in. to 36.
481. 7.2 in.
482. 221; 238; 255.
484. 24 ft.
485. 384 books.
486. $314\frac{1}{2}$ cu. ft.
487. 6,196 cu. in.
488. 144,000 cu. ft.
489. 10 acres; 90 acres.
490. 972 sq. yds.
491. $\frac{5}{8}$ mile.
492. 820 in.
493. 60 ft. 9 in.
494. 13.8 min.
495. 3.5568 acres.
496. 210 sq. ft.
497. 1,120 yds.
498. 84 ft. 10 in.
499. 800 yds.
500. 3,468 sq. ft.
501. $1\frac{1}{2}$ in.
502. 243 in.
503. 360.55 yds.
504. 150 sq. ft.
505. 12 ft.
506. 594 yds.
507. 133,837 sq. ft.
508. 864.
509. 141.42 yds.
510. 15 in.
511. $2{,}604\frac{1}{8}$ lbs.
512. 480.
513. $3\sqrt{3}:1$.
514. 176,786.
515. 648.
516. 512.
517. 27; 18; 12 ft.
518. 60 ft.
519. 36 ft.
520. 4,840 cu. ft.
521. 9 cu. in.
522. 3 cu. ft. 12 in.
523. 457 yds.
524. 38,304 sq. yds.
525. 52 ft.
526. 5.365 sq. ft.
527. 242 yds.
528. 4 a. 3 rds. 27.67 po.
529. 25 ft.
530. 64.4 yds.
531. 1,640 ft.
532. $38.48+$ ft.
533. $\frac{6}{10}$ ft.
534. 1,440 times.
535. Twice as great.
536. 33 ft.
537. 65 ft.
538. 14 ft. 5 in.
539. 60 miles.
540. 33 ft.
541. 77 ft.
542. 39 ft.
543. 60 ft.
544. 288 sq. ft.
545. 6 yds. 2 ft. $7\frac{1}{2}$ in.
546. 1,444 sq. yds.
547. 420 sq. ft.
548. 44 in.
549. 1,050 sq. in.
550. $20\frac{1}{4}$ ft.
551. 8,400 sq. yds.
552. $12\frac{1}{2}$ ft.
553. 528 ft.
555. 4 min.
556. 42,075 trs.
557. 30,000 sq. yds.
558. $282\frac{2}{3}$ sq. yds.
559. 2 ft.
560. 13 ft.
561. 30 yds.
562. 28 ft.; 15 ft.; 41 ft.
563. $10\frac{1}{2}$ ft.
564. 16 yds.
565. 3,468 sq. ft.
566. $4:\sqrt{3}$.
567. 25 ft.
568. 1,125 acres.
569. $5\frac{1}{7}$ in.
570. 82.

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571. 1,200 yds.
572. 151½ acres.
573. 13½ acres.
574. 30 acres.
575. 10 ft.
576. 253.18 ft.
577. 490.9 sq. yds.
578. 188.9 miles.
579. 111.8 sq. in.
580. 1 acre.
581. 4,033.8 sq. yds.
582. 56 yds. nearly.
583. 60 ft.
584. $6\frac{1}{18}$ ft.
585. 20,168+.
586. 3,232.
587. 864 planks.
588. 759 tiles.
589. 500 lbs.
590. 1,925 lbs.
591. $25\frac{1}{2} \times 17$.

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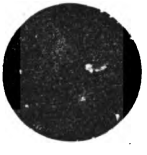

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